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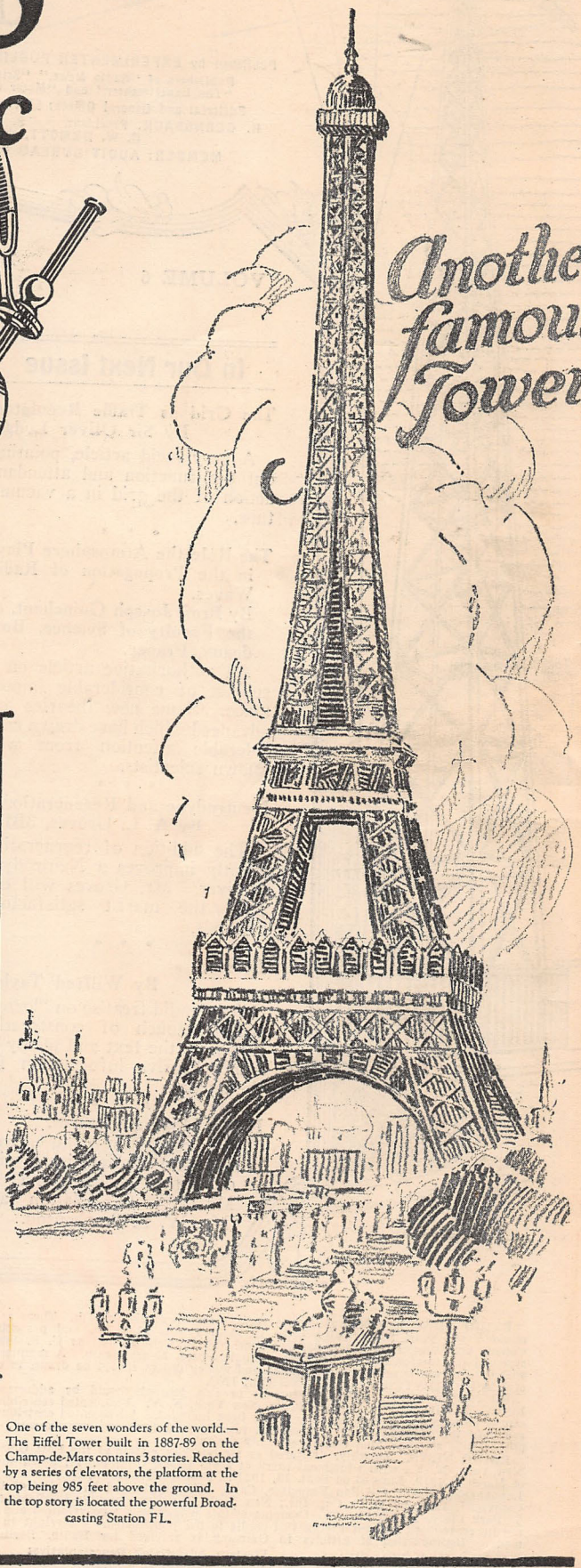

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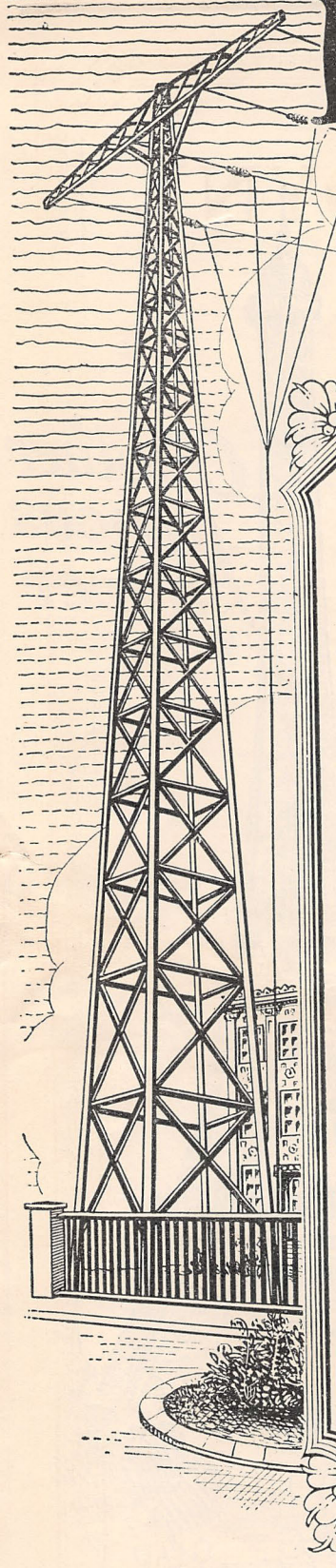

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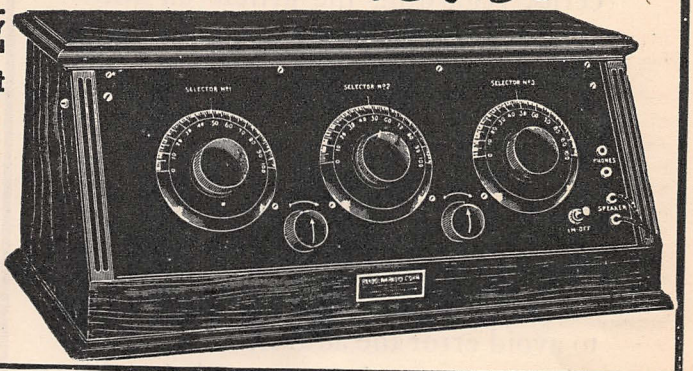

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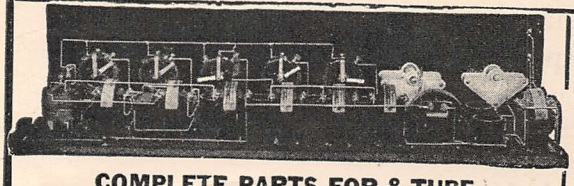

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- 2 4-in. Bakelite Dials
- 2 4½-volt C Batteries

Complete wiring diagrams, base board layout, blue-prints and instructions. **$59.75**

COMPLETE PARTS FOR 2-TUBE HARKNESS SET

including **Licensed Harkness Coils,** Drilled Panel and wiring diagram. Easy to build. Wonderful results..... **$17.95**

COMPLETE PARTS FOR REINARTZ

1-Tube Reinartz Set..... **$10.45**

3-Tube Reinartz Set..... **$17.55**

COMPLETE PARTS FOR 5-TUBE

NEUTRODYNE RECEIVING SET

Genuine Hazeltine Licensed Fada, or other Genuine Licensed Parts

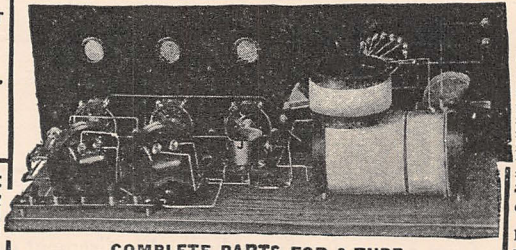
- 1 7x24x¼ Drilled Panel
- 2 Thordarson or Columbia Audio Transformers
- 3 4-in. Bakelite Dials
- 2 Precision Jacks
- 1 Bakelite Rheostat, 30-ohm
- 1 Bakelite Rheostat, 6-ohm
- 1 Bakelite Binding Post Strip
- 7 Marked Binding Posts
- 1 Grid Leak and Condenser
- 5 Bakelite Sockets
- 1 .001 Condenser
- 1 .006 Mica Condenser
- 35 feet Hook-up Wire
- 1 Kit consisting of 3 Hazeltine Licensed Neutroformers and 2 Neutrodons
- 1 Baseboard
- 3 Bezels

Complete blue-prints and working diagrams. **$33.45**

COMPLETE PARTS FOR 5-TUBE IMPROVED COCKADAY RECEIVING SET WITH RESISTANCE COUPLED AMPLIFICATION

As designed by L. M. Cockaday.

Including drilled panel and wiring diagram, complete, ready to wire. **$39.65**



Easy to Build Your Own Radio Set

All complete parts for sets on this page consist of **standard advertised guaranteed parts** and include **drilled bakelite panels** and **wiring diagrams** for easy set construction.

Everything guaranteed on money-back basis. All transportation charges paid. **Don't forget!** Only genuine guaranteed parts used. Lack of space does not permit us to itemize individual parts, but you are fully protected by our money-back guarantee. **Our Service Division is behind you.**

FREE BIG MONEY SAVING RADIO CATALOG

containing a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. Also the names of a few friends. We will send catalog free.

Free Service Department

Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is **free** to our customers.

COMPLETE PARTS FOR 3-TUBE

COCKADAY RECEIVING SET

- 1 Cockaday Coil
- 2 23-Plate Hy-Grade Cond.
- 1 Bakelite Rheostat, 6-ohm
- 2 Bakelite Rheostat, 30-ohm
- 3 Bakelite Sockets
- 1 high ratio Columbia or Thordarson Transformer
- 1 Single Circuit Jack
- 1 low ratio Columbia or Thordarson Transformer
- 2 Double Circuit Jacks
- 2 3-in. Bakelite Dials
- 1 Grid Leak and Mica Cond.
- 7 Switch Points. 2 Stops.
- 1 Bakelite Binding Post Strip
- 7 Binding Posts
- 1 7x21x¼ in. Drilled Bakelite Panel
- 3 Bezels
- 1 Baseboard
- 1 Switch Lever
- 24-ft. Hoop-up Wire

Complete blue-prints and wiring diagrams. **$18.55**

1-Tube Set **$10.10**

Genuine Radio Corporation Tubes UV201-A, UV199, WD12 or WD11	$ 3.55
Home Charger, 6-volt	12.95
Soldering Iron	.95
Solderall Tube	.19
Approved Lightning Arrester	.35
Cockaday Coils	1.59
Balancing Condensers, per pr.	.59
Harkness Coils, per set	1.95
Hydrometer, Best Quality	.44
Battery Meters, 0 to 50 volts	.89
Magnavox, M4, Loud Speaker	20.95
Baldwin Loud Speaker	21.45
Brandes Table Talker	8.45
Atlas Loud Speaker	21.95
Multiple Four Phone Plug	.89
Two Phone Plug	.24
Complete Antenna Outfit, including Lightning Arrester	2.59
Bakelite Moulded Variometer	3.25

Low Loss Condensers:
11-plate..... $1.85
23-plate..... 2.05
43-plate..... 2.85

Bakelite Rheostats:
6-ohm..... $0.35
30-ohm..... .38

Amperites:
For all tubes... $0.94

Bakelite Dials:
2-inch..... $0.26
3-inch..... .35
4-inch..... .48

Composition Dials:
2-inch..... $0.13
3-inch..... .17
4-inch..... .29

Accuratune Dials $3.14

Audio Transformers
Thordarson:
3½ to 1..... $3.25
6 to 1..... 3.65
Acme..... 3.95
Columbia:
3½ to 1..... $3.79
6 to 1..... 3.89

American Bell:
3½ to 1..... $2.45
6 to 1..... 2.79

Randolph Special:
3½ to 1..... $1.89
6 to 1..... 2.16

Randolph Special Headphones.... $2.24

RANDOLPH RADIO CORPORATION

159 North Union Ave. Dept. 394 Chicago, Illinois

RADIO NEWS READERS' BUREAU

Time and Postage Saver

IN every issue of RADIO NEWS you undoubtedly see numerous articles advertised about which you would like to have further information. To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in RADIO NEWS.

If there is any Manufacturer not advertising in this month's issue of RADIO NEWS, from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

TEAR ALONG THIS LINE

RN-3-25

READERS' SERVICE BUREAU,
Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of RADIO NEWS.

☞ DO NOT USE THIS COUPON FOR TECHNICAL QUESTIONS

NAME	ADDRESS (Street — City — State)	List here specific article on which you wish literature.	If Catalogue of complete line is wanted, check in this column

Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

NAME	ADDRESS (Street — City — State)	

Your own name here .....

☐ If you are dealer check here.

Address .....

City ..... State .....

Make this test yourself

ASK your dealer to let you hear an Adler-Royal Radio Speaker side by side with any speaker in his store. Operate its magic modulator yourself and see how it instantly adapts its tones to your mood. Be sure to notice how free it is from the noises you have formerly associated with loud speaker reception.

Whether it is the strident note measures of a jazz band or the plaintive notes of a world renowned violinist, put yourself under spell of Adler-Royal tone quality. Then make the hardest test of all. Tune in on a station that is broadcasting piano music, and observe how the wonderful Adler-Royal actually reproduces music that really sounds like a piano.

The secret of Adler-Royal natural tone

The remarkable purity of tone in Adler-Royal is accomplished in two ways. The horn itself, which is concealed in the cabinet, is designed strictly in accordance with certain principles of accoustics which preserve pure tonal qualities. This, coupled with the tone modulator, easily accessible, gives you perfect control over tone volume and quality.

You tune in your radio set for maximum amplification so that every delicate overtone is caught and amplified and then by this modulator you blend and soften this tone to your own mood.

The cabinet design of Adler-Royal Radio Speakers provides a setting that will grace the finest living room.

Our experience of 25 years in producing fine pianos, organs and phonographs enables us to offer this speaker at the extremely reasonable price of $30.00. In two finishes, either duo-tone walnut or mahogany.

ADLER MANUFACTURING COMPANY

New York Louisville

Adler-Royal Radio Speaker

ADLER MANUFACTURING CO.,
Dept. D3, 881 Broadway, N. Y.

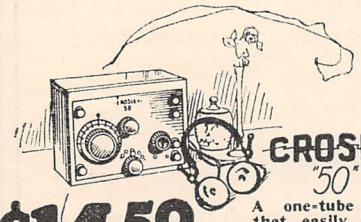
I should like to know the name of a dealer near me where I can compare an Adler-Royal Radio Speaker. Also please send me The Adler-Royal Catalog and Log.

Name .....

Address .....

CROSLEY AGAIN LOWERS PRICES

Big Reduction in Famous Tridyn and other Radios



CROSLEY "50"

$14.50

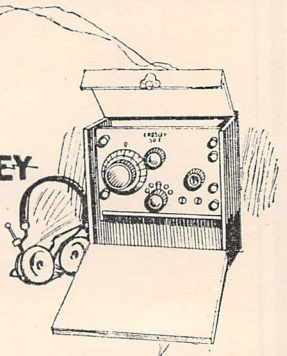
A one-tube radio that easily brings in distance with phones.

The biggest selling high grade receiver on the market—the Crosley Tridyn—reduced from $65 to $50.

The Tridyn Special—the beautiful Model with cabinet to house batteries—formerly $75, now $60.

The Crosley 51-P, a tremendous seller at $25, reduced to $23.50.

We unhesitatingly state that these sets, together with the other Crosley Radios, represent the biggest values ever offered.

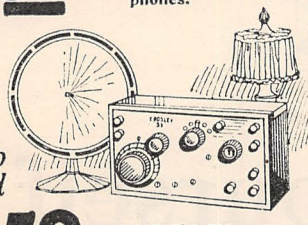


CROSLEY "50P"

The new leatherette covered one-tube utility set. Will give the same rsults as the Crosley 50.

$16

The biggest selling radio in the world



$18.50 **CROSLEY "51"**

A two-tube set that gives loud speaker reception under fair conditions up to 1000 miles.

CROSLEY RADIOS JUSTLY POPULAR

Only the less expensive Crosley Radios have exceeded the Tridyn in sales. This deserved popularity of the entire Crosley line is the result of extraordinary performance at a very low price.

Crosley Radios cost less originally, use fewer tubes and consume much less battery current. At the same time they give results not equalled by receivers costing a great deal more and using two or three additional tubes.

The unique Tridyn circuit—a combination of Armstrong Regeneration, Radio Frequency Amplification and Reflexed Audio Amplification—has proven beyond a doubt that the features of selectivity, volume and ease of operation can be obtained with three tubes better than heretofore has been possible with five or even six.

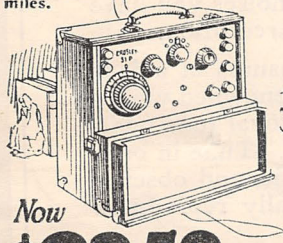
Hundreds of voluntary letters have come to us, telling of the unparalleled foreign reception during international test week with Tridyns and all other Crosley Radios; even the little one-tube Crosley 50 at only $14.50.

It is this continued remarkable performance that has created such a tremendous demand for Crosley Radios. And it is this great popularity that now allows us to decrease our production costs and pass this large saving along to you.

CROSLEY "51" Special

Same as 51 in new sloping panelled cabinet which houses all necessary batteries.

$23.50



CROSLEY "51" Portable

The two-tube utility radio. Let your dealer hook it up in his store.

Now **$23.50**

NEW CROSLEY MODELS

In order to allow even a greater selection, three new Crosley Radios have been added to our extensive line. Taking its place with the well known Crosley 50 and Crosley 50-P is the leatherette covered, one-tube 50 Portable, a utility set in which the dealer can quickly make the necessary connections and allow you to carry it home complete.

The New Crosley 51 Special, a two-tube receiver similar to the Model 51, is housed in a cabinet large enough to hold the necessary batteries and has a sloping panel.

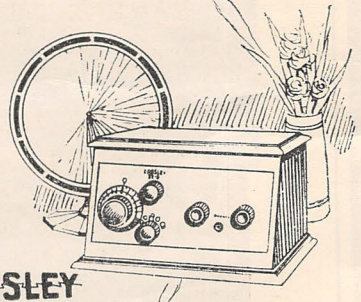
Similar to the Crosley 52, but with sloping panel and cabinet to house the batteries is the new Crosley 52 Special.

These additional receivers make the Crosley line absolutely complete—A radio for all tastes and every pocketbook. See illustrations for prices.

No matter what appeals to you most in a radio, you will find that point outstanding in a Crosley.

Most good dealers handle Crosley Radios.

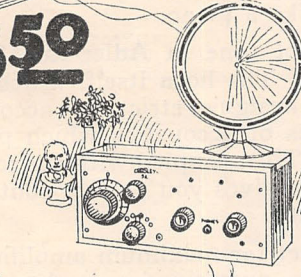
You Will Make No Mistake in Buying One.



CROSLEY "52" Special

The Crosley 52 in new cabinet to house batteries. Has sloping panel.

$35



$30 **CROSLEY "52"**

A three-tube regenerative set that gets distance with the loud speaker. Becoming more popular every day.

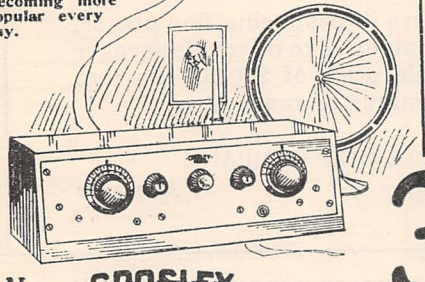
All Crosley Receivers contain the famous Armstrong Regenerative circuit, and are licensed under the Armstrong U. S. Patent No. 1,113,149

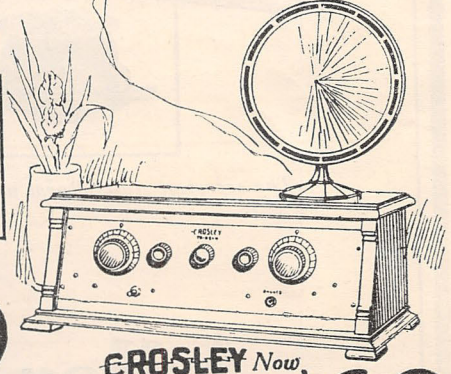
As is customary prices shown do not include tubes, phones, loud speakers or batteries

Prices West of the Rockies add 10%

From a small beginning three and a half years ago, Crosley Radio has grown until it now produces more sets than any other concern in the world. The present production—nearly 5000 per day—is probably from two to three times as great as that of any other radio manufacturer.

Crosley owns and operates the new super power WLW Broadcasting Station located at Harrison, Ohio, remotely controlled from studios in one of three large Crosley owned manufacturing plants in Cincinnati.





3 Tubes do the work of 5

In a CROSLEY Tridyn

Now **$50** **CROSLEY "TRIRDYN"**

The biggest selling high-grade radio on the market. Distant loud speaker reception under all conditions.

CROSLEY *Now* **"TRIRDYN" Special** **$60**

Same as the Tridyn in beautifully finished large cabinet to hold the batteries.

THE LOUD SPEAKER SHOWN IS THE WONDERFUL NEW CROSLEY LOUD SPEAKER THAT IS TO BE ANNOUNCED IN THE NEAR FUTURE

Write For Complete Catalog

THE CROSLEY RADIO CORPORATION

322 Sassafras Street — Powel Crosley, Jr., President — Cincinnati, Ohio

THE success of any manufacturer depends, in a great measure, upon the type of Distributors selling his merchandise. We are justly proud to have associated with us as distributors of Crosley Radio, those whose names you will find listed below. Dealers and other interested persons may write them with full confidence that their Crosley needs will be promptly, courteously and efficiently cared for.

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Powel Crosley, Jr., President,
Cincinnati.

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We Do Not Retail
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112 Page
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(Established 1879)
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Prompt service to the Northwest
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ERIE, PA.

FRANKLIN ELECTRIC CO.
15 North Seventh St.
Philadelphia
CROSLEY
Distributors

ADDITIONAL CROSLEY Better-Costs Less Radio DISTRIBUTORS

PENNSYLVANIA—Cont.

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920 Penn Avenue
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CROSLEY
Wholesale Exclusively

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CROSLEY
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We Serve you Promptly
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JOHNSTOWN AUTOMOBILE COMPANY
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Radio Sets and Accessories
101-111 Main St., Johnstown, Pa.

Dealers Attention! Order Your
CROSLEY SETS
from
MOTOR PARTS CO.
1425 N. Broad St. Philadelphia, Pa.
Mail orders promptly filled.

R. M. PEFFER
Distributor of
CROSLEY RADIO
HARRISBURG, PA.

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SOUTH DAKOTA

POWER CITY RADIO CO.
Sioux Falls, South Dakota
Exclusive CROSLEY Radio
Largest Radio Jobbers in the State
Dealers: Write for catalog and discounts

TENNESSEE

CROSLEY RADIO
We handle Sporting Goods and Crosley Radio in West Tennessee, Eastern Arkansas and North Mississippi.
BUCKINGHAM-ENSLEY CARRIGAN CO.
MEMPHIS, TENN.

W. C. TEAS COMPANY
Distributors for
CROSLEY RADIO
Chattanooga, Tenn.

TEXAS

We are distributors for
CROSLEY RADIO
SOUTHERN EQUIPMENT COMPANY
San Antonio, Tex., Mexico City

C. C. WHITE ELECTRIC CO.
Distributors for
THE CROSLEY LINE
Dealers—Send for Catalog
1909 Commerce St., Dallas, Tex.

WASHINGTON

CROSLEY
Distributors
GLOBE ELECTRIC CO.
311 Second Ave., South,
Seattle, Washington

THE L. C. WARNER COMPANY
CROSLEY
"Wholesale Only"
SEATTLE PORTLAND
We Do Not Sell In Competition With Our Dealers

WEST VIRGINIA

MOTOR CAR SUPPLY CO.
Distributors for
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and good Radio Accessories
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BADGER RADIO
495 E. WATER ST. CO. MILWAUKEE

WE HAVE
CROSLEY RECEIVERS
When You Want Them
T. W. MEIKLEJOHN CO.
Fond du Lac, Milwaukee, Wisconsin

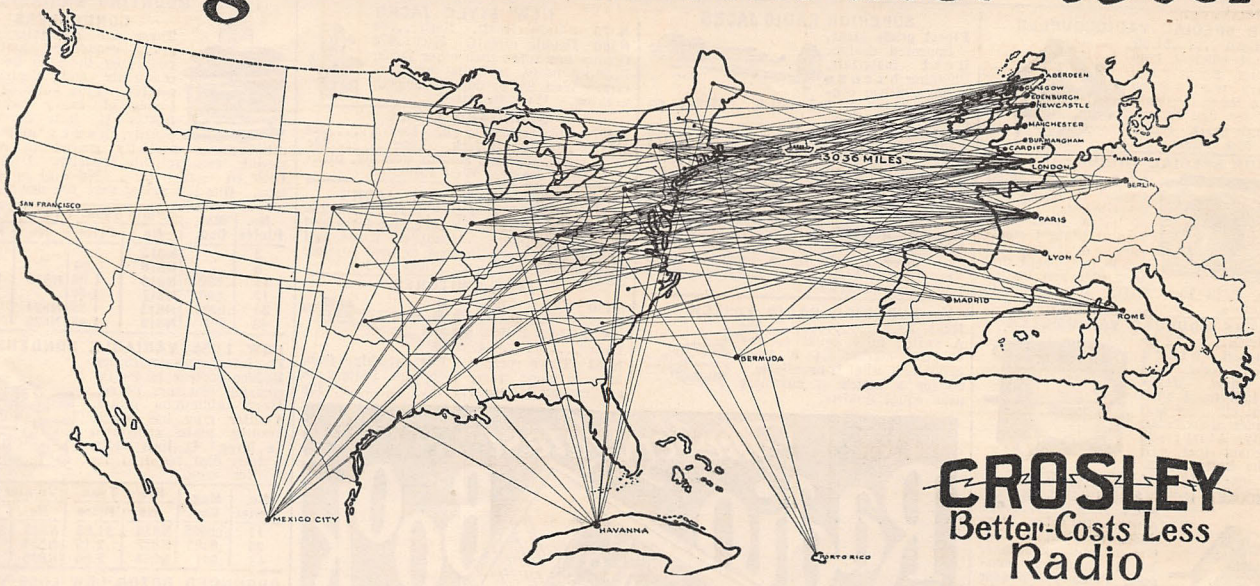
We have the best location for RUSH shipments on
CROSLEY
into Wisconsin, Minnesota and Iowa.
W. A. ROOSEVELT CO.
La Crosse, Wisconsin

CROSLEY
Two Tube 51-S, $23.50
Similar to the regular 51 at $18.50 except that it has cabinet with new sloping panel and ample space to house all dry batteries.
With tubes and Crosley Phones, $35.25

Crosley Owns and Operates
Radio Station WLW

THE CROSLEY RADIO CORPORATION

CROSLEY Radios Bring 'Em In During International Test Week



CROSLEY
Better-Costs Less
Radio

UNUSUAL STATIONS HEARD ON CROSLEY 3-TUBE 52

Claiming that no radio can beat a Crosley 3-tube 52—price $30—a resident of Boston writes:

"I cannot refrain from writing you of the reception received on one of your Model 52 sets. Following is a list of unusual stations heard from November 23rd to November 30th; Newcastle, England; Glasgow, Scotland; Tuinicu, Cuba. If any set can beat this for reception, I would like to see it."

FOREIGN LOUD SPEAKER RECEPTION REPORTED BY TRIRDYN OWNERS

That Crosley Trirdyns—priced now at only $50.00—give universally good performance is proven by unsolicited reports from every part of the United States.

A man writes from Morocco, Ind:

"Thought you might be interested to know that last night I received Berlin, Germany and Aberdeen, Scotland on my Trirdyn on the loud speaker so you could hear it all over the room. Trirdyns are some machines."

Reception on a Trirdyn in Broken Arrow, Arkansas, seems to be just as good. A man writes:

"I want to tell you what I think of your radios. I have a Trirdyn and it's just great. During the International Test Week, I listened to Germany, Italy and England. I get Canada, Old Mexico and Havana, Cuba most any night and stations from Coast to Coast. I wouldn't be without a Trirdyn for anything."

THE excerpts from letters given herewith are not the exception but the rule. They were chosen at random from among hundreds that reached us after International Test Week.

Reports from newspapers that asked for results show that more people heard foreign stations on Crosley sets than any other make.

Any Crosley dealer or jobber can tell you of many similar performances. On the following pages are listed many of the Crosley distributors in all parts of the country. We refer you to any one of these as to the continued successful performance of all Crosley Radios.

CONTINENT TO CONTINENT RECEPTION, SAYS OWNER OF CROSLEY 50

The one-tube Crosley 50 at $14.50, has opened the eyes of radio enthusiasts everywhere to what true radio reception really is.

Here's what a man in Matoon, Ill. writes:

"I want to thank you for the success of your one-tube Crosley 50. I can say it will reach not only from Coast to Coast but from Continent to Continent. Two of us listened to London, England; Aberdeen, Scotland, and Eiffel Tower, Paris, France."

HASTINGS, NEBR. HEARS GERMANY AND SPAIN ON CROSLEY 2-TUBE 51

The extraordinary results obtained with the Crosley 2-tube 51—the biggest selling radio in the world—price $18.50 are brought to our attention constantly by voluntary letters similar to the following:

"I am writing to tell you about the remarkable results obtained from my 2-tube Crosley Model 51-P. There is not a single station received by my neighbors' six and eight tube sets that I have not gotten in either the U. S., Cuba, Canada or Porto Rico. During the week of foreign station broadcasting, I received Madrid, Spain and a station in Germany. Remember all of these results were obtained with my loud speaker. I think my results are far ahead of any owner of any other set than a Crosley."

CROSLEY ONE-TUBE 50 BRINGS IN LONDON CLEARLY

From all parts of the United States, foreign stations were heard on the little one-tube Crosley 50 Radio which costs only $14.50.

Here's what a man in Osceola, Nebr. writes:

"While listening in on various stations Saturday night, November 8th, I heard 2LO London. The announcement and program came in plainly and clearly. I thought this might be of interest to you because my set is a Crosley Model 50."

Write for Complete Catalog

The Crosley Radio Corporation

322 SASSAFRAS STREET

Powel Crosley, Jr., President

CINCINNATI, OHIO

Crosley owns and operates Broadcasting Station WLW

BARAWIK

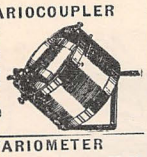
It is Easy to Build Your Own Radio Set

QUALITY

WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES ON ALL ITEMS EXCEPT BATTERIES, PANELS AND CABINETS. THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR. ALL ORDERS SHIPPED SAME DAY RECEIVED.

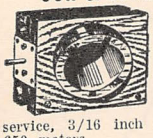
HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

OUR SPECIAL VARIOCOUPLER



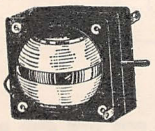
N418 Each $1.35
The most efficient type of coupler. Primary and secondary wound on bakelite tubes. Primary tapped for fine tuning. 3/16 inch shaft. Range 180 to 650 meters.

OUR SPECIAL VARIOMETER



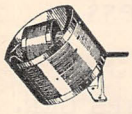
N410 Each ...$2.00
Perfect in design and construction. Plenty of large sized wire insures highest efficiency. A strong high grade instrument that will give you lasting service, 3/16 inch shaft. Range 180 to 650 meters.

PATHE MOULDED VARIOMETER



N412 Each.....$2.30
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

EXCEL 180° VARIOCOUPLER



N521 Each.....95c
A wonderful value. Produces excellent results. Green silk windings. Rigid mounting support. Primary tapped for fine tuning. ¼ inch shaft. Range 200-600 Meters.
N522 Variometer—same style. Each 95c

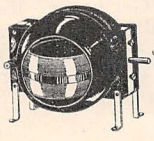
RAVEN BAKELITE VARIOMETER

N525 Each.....$3.90
Forms moulded of red bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Produces superior results in any type circuit 180 to 650 meters.
N527 Variocoupler. Same style. Primary tapped for fine tuning. Each.. ..$3.95

SUPERIOR VARIOCOUPLER

N523 Each.....$3.48
Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.
N526 Special type for single circuit Regenerative Hook-up. Each.....$3.90

SPLIT STATOR VARIOMETER



N524 Each.....$3.70
A wonderful value at our price. Polished black bakelite rotor and stator forms. Large size green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Split stator winding.

STANDARD BRAND VARIOMETERS AND VARIOCOUPLERS

N406 Pfanstiehl Variometer $3.90
N407 Pfanstiehl Variocoupler 3.95
N408 Coto Variometer 3.95
N409 Coto Variocoupler 4.30
N528 Premier Variocoupler 2.85

STANDARD BRAND THREE CIRCUIT TUNING COILS

N551 Ambassador $5.95
N552 Uncle Sam 4.60
N547 Bremer-Tully 4.45
N558 Flewelling 6.95
N559 Pfanstiehl 4.45
N554 Lopez 8.95

SWITCH LEVERS

Very neat polished composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch. 1¼ inch radius.
N381 With black knob. Ea. 14c
N382 With mahogany knob. Each.....18c

INDUCTANCE SWITCH

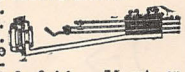
N285 Price including knob and dial $1.18
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 12 switch points, any number of which may be used.

SPIDER WEB COILS

N290— 25 turn 39c N292—50 turn 47c
N291— 35 turn 42c N293—75 turn 54c
N294—100 turn. Each 68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with mounting strips.

SUPERIOR RADIO JACKS

Finest grade jacks.

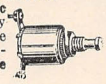


Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
N390 Open circuit. Each.....32c
N391 Closed circuit. Each.....39c
N392 Two circuit. Each.....49c
N393 Single circuit filament control..46c
N394 Two circuit filament control.....59c

RADIO SWITCH

N287 Each.....27c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

SUPERIOR RADIO SWITCH



N283 Each.....25c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

NEW STYLE JACKS

N379 Single circuit. Each...30c
N380 Double circuit. Each..47c
Occupy less space than other jacks. Binding posts, soldering unnecessary. Well made, durable smooth working. Well insulated.

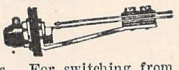
STANDARD JACKS

N387 Open circuit jack. Each.....22c
N388 Two circuit jack. Each.....28c
Well made, durable, smooth working, nickel finished frame. Well insulated.

CORD TIP JACKS

N389 Pair 23c
Eliminates expensive jacks and plugs. Mount on panel and insert headset or loud speaker cord tips. Nickel finish.

JACK SWITCHES



N280 Two springs. Usually used as "A" battery switch. Each 47c
N281 Three springs. For switching from long to short wave, from one battery to another, etc. Each.....55c

The Very Latest Radio Book Free

This Book Full of Radio Bargains.

Shows Big Savings on parts, sets and accessories.

Our prices are lowest on highest quality standard goods.

Send for your copy today

ALL ORDERS SHIPPED SAME DAY RECEIVED

INDUCTANCE COILS (Honeycomb)

Carefully made—fine looking coils. Low resistance—high self inductance. Very firm impregnation. Mounted coils have standard plug mountings. Specify when ordering whether mounted or unmounted type is wanted.

Tns	Art No.	Not Mtd	Mtd	Tns	Art No.	Not Mtd	Mtd
25	N301	$.28	$.75	200	N307	$.66	$1.20
35	N302	.30	.90	500	N311	1.06	1.57
50	N303	.32	.96	1000	N314	1.64	2.18
75	N304	.37	1.02	1250	N315	1.86	2.35
100	N305	.52	1.07	1500	N316	2.10	2.50

INDUCTANCE COIL MOUNTINGS

N340 3 Coil..$2.75 N341 2 Coil..$2.35
Made of polished black bakelite. Mount on front of panel.
N342 Mounts back of panel, with knobs or dials on front of panel. Takes 3 coils of any size. Each $3.25

MAGNET WIRE

Prices quoted are for 8 oz. spools unless otherwise stated. Prices are prepaid.

Double Cotton White	Enameled	Wire Size	Single Silk Green	Double Silk Green
N990	N992		N991	N993
42c	37c	18	60c	85c
50c	41c	20	72c	95c
59c	43c	22	80c	$1.10
68c	46c	24	85c	1.15
85c	53c	26	$1.04	1.59
98c	55c	28	1.25	1.70
$1.25	63c	30	4 oz. 80c	4 oz. 1.15
1.40	69c	32	4 oz. 1.05	4 oz. 1.50
	80c	36	4 oz. 1.60	4 oz. 2.45

BAKELITE TUBING

Genuine bakelite tubing. Pieces 3 inches long only.
N985 Inside dia. 2½ in..32c
N986 Inside dia. 3 in....42c
N987 Inside dia. 3½ in.....42c
N988 Inside dia. 4 in.....45c

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish.
N732 Each 62c

FRESHMAN DETECTOR

N760 Each $1.19
A double adjustable crystal detector especially suitable for reflex and other sets requiring a high grade detector. For front or back of panel mounting.

DETECTOR CRYSTALS

N736 Galena, Arlington tested, piece 20c
N738 Silicon, Arlington tested, piece 20c
N735 Tested Galena, Mounted, piece 7c
N737 Tested Silicon, per piece..... 8c
N746 Dutec Crystal. Each.....26c

STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest developments in Crystal Detectors. Used in Reflex circuits.
N742 Grewol Detector. Each.....$1.12
N747 RW Detector 1.20
N749 Brownlie Detector 1.69
N750 Brownlie Renewal 69

DUBILIER MICADON TYPE 601

N502 .0001..29c N507 .0025..33c
N503 .00025..29c N508 .003...40c
N504 .0005..29c N509 .004...40c
N505 .001...33c N510 .005...48c
N506 .002...33c N511 .006...60c

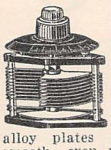
DUBILIER MICADON 601G

Same style condenser as above with mounting for tubular grid leak. No grid leak included.
N581 .00025. Each 38c
N582 .0005. Each 38c

DUBILIER MICADON 601T

Consists of a Type 601 condenser with brackets designed to fit over terminals on audio frequency transformers, binding posts, etc.
N583 .001 mfd..42c
N584 .002 mfd..42c N585 .0025 mfd..42c

PANEL MOUNTING VARIABLE CONDENSERS



These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Dial and knob on vernier type. No dial on plain type. Our low prices save you money.

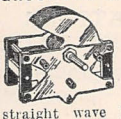
No. Plates	Max. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
3		N815	$.79		
5		N816	.89		
11	.00025	N814	1.00	N825	$1.85
17	.00035	N817	1.20		
23	.0005	N813	1.30	N824	2.25
43	.001	N812	1.45	N826	2.40

LOW LOSS VARIABLE CONDENSERS

The latest type condensers. Reduce current losses increasing efficiency of set. Heavy aluminum plates. Vernier type has single vernier plate controlled by lever. ¼ inch shaft. 3 inch dial required for vernier type.

No. Plates	Max. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
11	.00025	N836	$1.95	N833	$2.15
23	.0005	N837	2.15	N834	2.95
43	.001	N838	2.90	N835	3.90

GROUNDED ROTOR LOW LOSS VARIABLE CONDENSERS



N797 .0003 .....$2.75
N798 .0005 ..... 3.25
N799 .001 ..... 3.95
The most efficient type condenser made. Low losses, grounded rotor, straight wave line. Made of the best grade materials throughout. Heavy aluminum plates. Well insulated.

STANDARD BRAND VARIABLE CONDENSERS

N810 Acme .0005 Vernier $5.65
N784 Coto .00025 Vernier 3.95
N785 Coto .0005 Vernier 4.25
N786 Coto .001 Vernier 4.95
N820 Remler .00035 ..... 4.45
N821 Remler .0005 ..... 4.45
N787 King Cardwell .00025 ..... 3.95
N788 King Cardwell .00035 ..... 4.35
N789 King Cardwell .0005 ..... 4.60
N790 King Cardwell .001 ..... 5.55
N791 Marco .00025 ..... 3.85
N792 Marco .00035 ..... 4.10
N793 Marco .0005 ..... 4.85
N794 Marco .001 ..... 5.85
N795 Flewelling .00025 Vernier 4.50
N796 Flewelling .0005 Vernier 4.95
N775 Bremer-Tully .00028 ..... 4.05
N776 Bremer-Tully .00051 ..... 4.50
N777 Bremer-Tully .0008 ..... 5.85
N780 Continental .00025 Vernier ... 4.70
N781 Continental .0005 Vernier 5.05
N778 Chelten Midget 1.35
N827 Mignon .0002 Vernier 1.95
N828 Mignon .0005 Vernier 2.30
N829 Mignon .001 Vernier..... 2.75

FRESHMAN VARIABLE GRID LEAKS

N177 Back of panel style..59c
N178 Back of panel style with .00025 Condenser....79
N171 Base mounting type with .00025 Condenser....69c

STANDARD BRAND VARIABLE GRID LEAKS

N173 C.R.L. without condenser $1.05
N175 C.R.L. with .00025 condenser.. 1.35
N168 Bradleyleak without condenser 1.74
N169 Bradleyleak with .00025 condenser 1.95

TUBULAR GRID LEAKS AND CONDENSERS

Cut shows leak or condenser mounted, but all parts are priced separately.
N849 Grid leaks (can be used with Dubilier 601G condensers) 10c
Resistances ½, 1, 1½, 2, 3, 5, 7 and 10 megohms. Specify resistance.
N831 Grid and Plate Condensers. Ea. 29c
Capacities .000025, .0001, .00025, .0005. Specify capacity.
Mountings—Bakelite Base
N840 Single. Each 15c
N842 Double. Each 27c
N844 Triple. Each 39c

TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
N957 Round. Ten feet for.....12c
N958 Square. Ten feet for.....14c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
N955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for.....14c
N956 Best quality braid and covered with black insulating compound. 3 feet for..9c

The Barawik Co.
102 So. Canal St. Chicago, Ill.

With Barawik Standard Radio Goods

BARAWIK — SERVICE

We have many thousands of customers all over the world. You take no risk in dealing with us. We are one of the oldest and most reliable radio supply houses. "RADIO NEWS" guarantees our reliability. Let us serve you and save money for you. All orders shipped same day received.

VACUUM TUBES

Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect and in original carton. We will ship brand in stock unless you specify otherwise.

N105 Detector, UV200, C300. Each $3.59
N112 Amplifier, UV201A, C301A. Each 3.59
N118 5-Watt Transmitter.. 7.48
N107 WD11, C11. Each.. 3.59
N101 WD12, C12. Each... 3.59
N102 UV199, C299. Each.. 3.59

ADAPTERS

To use dry cell tubes in standard base sockets simply insert one of these adapters in the socket.

N104 For 199 or 299 tubes...40c
N109 For WD11 or C11 tubes.45c

BAKELITE SOCKET

N140 Standard base...40c
N141 UV199 base.....40c
N136 C11 .....39c

Moulded of genuine red brown bakelite. Binding post connections. Strong contacts. Real values.

EXTRA STRONG SOCKET

N142 Standard base 38c
N138 C299 Base 38c

Extra heavy. Square base. Double reinforced contact springs. For standard base tubes. A wonderful value.

PANEL MOUNT SOCKET

N143 Single Gang ....$.48
N144 Three Gang 1.60

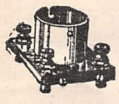
The best socket value obtainable anywhere. Extra heavy, moulded, genuine brown bakelite. Double reinforced contact springs. Will mount on panel behind rheostat. Standard base.

METAL TUBE SOCKET

N134 Each 25c

Nickel plated brass tube set in best grade composition base. Plainly marked binding posts. An excellent value.

STANDARD TUBE SOCKET



N150 Single Gang ..$.76
N153 Three Gang...2.25

Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

CUSHION BASE SOCKET

N145 199 Base 59c
N146 Standard Base.....75c

Moulded of high insulating material. Sponge rubber base. Non microphonic. Plainly marked binding post connections. Neat and compact.

BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

N370 Large size — barrel and knob ¾ in. long. Dozen ...70c

N376 Large size with hole for phone tip or wire. Dozen ...69c

N372 Smaller size barrel and knob 9-16" long. Dz. 50c

N378 Small size with hole for phone tip or wire Dozen 35c

LETTERED BINDING POSTS

N375 Set of eight 40c

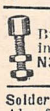
Nickel plated washers. Composition tops lettered as shown in illustration. Eliminate engraving. Improve appearance. Sold in sets of eight only.

COMPOSITION TOP BINDING POSTS

N374 Dozen 40c Hundred $2.70

Composition top, nickel plated body. 6/32 screw with washer.

SWITCH CONTACT POINTS

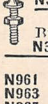


Brass polished nickel finish. Have ⅝ in. long size 6/32 screws and two nuts.

N363 Dozen..10c Hundred..75c
Thousand $5.50

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.



N365 Dozen....8c Hundred....27c

SWITCH LEVER STOP

Brass polished nickel finish.

N386 Dozen...14c Hundred...85c

BRASS ROD

N961 Threaded 6-32, per 8 in. length..8c
N963 Threaded 8-32, per 8 in. length.10c
N955 Solid 3-16 in., per 8 in. length..8c
N967 Solid ¼ in., per 8 in. length.11c

COPPER FOIL

N968 Per piece 25c

Thin copper foil for shielding panels. 6 inches wide, 2 feet long, .005 in. thick.

SUPERIOR RHEOSTATS

N147 6 ohm. Each.....62c
N148 20 ohm. Each.....66c
N149 30 ohm. Each.....70c

One of the finest rheostats we have ever seen at a price that makes it the best value obtainable anywhere. Genuine bakelite base. Beautifully shaped black bakelite knob with white arrow. Single hole mounting. A rheostat you will be proud to have in your set.

N156 400 ohm Potentiometer. Matches above rheostats. Each 95c

FILAMENT CONTROL RHEOSTATS

N132 6 ohm. Each....34c
N129 20 ohm. Each....36c
N131 30 ohm. Each....38c
N135 6 ohm Vernier..78c

Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob 1¼" diam. Potentiometers. Match above rheostats. Same high grade construction.

N151 200 ohm. Ea.52c N152 400 ohm. Ea.55c

HOWARD RHEOSTATS

A well known line of rheostats and potentiometers that is giving very satisfactory service to its users. Complete with knob and pointer.

N211 Plain 94c 6 ohm
N213 Plain 94c 25 ohm
N215 Plain 94c 40 ohm
N218 400 ohm Potentiometer 1.69
N212 Vernier $1.19
N214 Vernier 1.19
N216 Vernier 1.19

Single Hole Mounting Type with Dial

N350 Plain 98c 6 ohm
N352 Plain 98c 25 ohm
N354 Plain 98c 40 ohm
N357 400 ohm Potentiometer $1.74
N351 Vernier $1.25
N355 Vernier 1.25
N355 Vernier 1.25

BRADLEYSTAT and BRADLEYOMETER

N238 Bradleystat. Each....$1.74

Latest improved type. Can be used with all types of tubes.

Bradleyometer

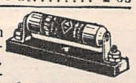
N209 200 ohm. Each.....$1.89
N210 400 ohm. Each..... 2.89

ACME POT-RHEO.

A rheostat and potentiometer combined in one unit. Does the work of two separate instruments. 300 ohm potentiometer.

N237 With 6 ohm rheostat.....$2.69
N238 With 20 ohm rheostat..... 2.69

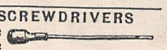
AMPERITES



Eliminates rheostats on amplifier tubes where adjustment is not critical. Automatically adjust resistance according to flow of current, keeping tubes at proper point for maximum efficiency. Complete with mounting.

N221 For UV201A or 301A tubes....98c
N222 For UV200 or C300 tubes.....98c
N223 For UV199 or C299 tubes.....98c
N224 For WD11 or C11 tubes.....98c

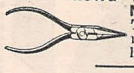
LONG BLADE SCREWDRIVERS



N947 6 inch 20c
N948 8 inch 25c
N949 10 inch 30c

Long narrow blade makes it easier to get in difficult places. Wood handle. Length given is over all.

LONG NOSE PLIERS



N970 Each 83c

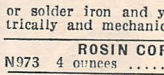
The handiest pliers for radio work. Made of fine hardened steel. Length 5".

DIAGONAL JAW NIPPERS

N972 Each 75c

For fine electrical work, made of hardened steel. Cuts wire clean in tight places. Length 5 inches.

TINOL



N969 Per tube..20c

A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

ROSIN CORE SOLDER

N973 4 ounces 25c

INSULATED BUS BAR WIRE

N959 Package of 5 30-inch pieces....49c

Tinned copper bus wire insulated with highest grade varnished covering. 5 pieces, one each color—yellow, brown, black, green and red. Using different colors makes tracing of circuits easy and sure, neater and lower cost.

SCREW ASSORTMENT

N960 100 pieces screws and nuts.....39c

Contains screws and nuts of size and style needed for assembling any radio set.

OUR SPECIAL A. F. TRANSFORMER

N549 3 to 1 ratio..$2.25
N550 5 to 1 ratio.. 2.45

In quality of tone and volume of sound, the tunings a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

TRICOIL R. F. TRANSFORMER

N560 For 201A or 301A Tubes $1.65

N551 For 199 or 11 or 12 Tubes 1.65

This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for use, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.

OTHER STANDARD BRAND AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.

N587 Thordarson Ratio 3½ to 1....$3.30
N588 Thordarson Ratio 6 to 1..... 3.70
N589 Thordarson Ratio 2 to 1..... 3.95
N590 Thordarson Push Pull. Pair..11.20
N553 Acme 3.95
N597 Erla 6 to 1..... 4.05
N598 Erla 3½ to 1..... 3.60
N591 Modern 10 to 1. Each..... 4.50
N592 Modern Push Pull. Pair.... 9.90
N555 Federal No. 226. Each..... 4.45
N556 Federal No. 65. Each..... 6.35
N712 Radio Corp. Each..... 5.70

STANDARD BRAND RADIO FREQUENCY TRANSFORMERS

N562 Dubilier Duratran $3.45
N565 Acme R2 ..... 3.95
N566 Acme R3 ..... 3.95
N567 Acme R4 ..... 3.95
N568 Erla Reflex No. 1..... 4.45
N579 Erla Reflex No. 2..... 4.45
N599 Erla Selectoformer 4.45
N710 Erla Crystal Detector..... .89

ALL AMERICAN PRODUCTS

N531 10 to 1 Transformer. Each..$4.25
N532 5 to 1 Transformer. Each... 4.25
N533 3 to 1 Transformer. Each... 4.05
N534 Push Pull Transformers. Pair.10.80
N535 Rauland Lyric Transformer... 8.10
N625 Intermediate Frequency 5.40
N626 Oscillator Coupler 4.50

RESISTANCE COUPLED AMPLIFICATION

N570 1st Stage Unit $2.30
N571 2nd Stage Unit 2.30
N572 3rd Stage Unit 2.49

Amplifies without distortion. Replaces audio frequency transformers using same circuit. Each unit consists of a mounting with condenser, grid leak and resistance of proper value for best results.

SUPERIOR RADIO PLUGS

Both styles take two sets of cord tips. Polished round barrels.

N397 With turned fibre barrel. Highest grade obtainable. Each.....40c
N395 With black moulded composition barrel. Wonderful value. Each.....27c

NEW STYLE PLUG

N401 Each 62c

Cords are held firmly in place but can be detached instantly without taking plug apart. No screws to loosen. Bakelite body. Fits all standard jacks. Best plug made.

MULTIPLE PLUG

N402 Each 69c

Attach any number of headsets up to four. Cords attached or detached instantly without taking plug apart.

RADIO SOLDERING IRON

N540 69c

This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches.

HEXAGON NUT WRENCHES

N950 Set of 3...60c

Handiest tool made for tightening hexagon nuts. Fit nuts for 4/36, 6/32, and 8/32 screws, the three most popular radio sizes.

RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. One side has attractive natural polished black finish which can be sanded and oiled. Other side mahogany finish. Either side may be used as front.

Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x6	N450	$.53	N460	$.85	N470	$1.15
6x10½	N451	.83	N461	1.20	N471	1.60
7x10			N455	1.28		
7x12			N456	1.60		
7x14	N458	1.32	N458	1.85	N478	2.35
7x18	N453	1.67	N463	2.40	N473	3.15
7x21	N457	1.95	N467	2.80	N477	4.10
7x24	N459	2.35	N469	3.15		
7x26			N462	3.25		
9x14			N464	2.35	N474	3.15
12x14			N465	2.97	N475	3.98
12x21			N466	4.25	N476	5.70

RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch.

Black Art No.	Price	Size Inches	Mahogany Art No.	Price
N481	$ .69	7x10	N493	$ .75
N482	.75	7x12	N494	.92
N483	.87	7x14	N495	1.09
N484	1.15	7x18	N496	1.34
N485	1.32	7x21	N497	1.55
N486	1.50	7x24	N498	1.75

COMPOSITION DIALS

Handsome dials moulded in one piece of polished composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 4 inch size have 180° scale marked 0 to 100.

Black No.	Price	Diam	Shaft Size	Mahogany No.	Price
N921	16c	2"	3/16	N92	19c
N922	16c	2"	1/4	N92	19c
N923	22c	3"	3/16	N92	26c
N924	22c	3"	1/4	N929	26c
N925	27c	4"	1/4	N93	32c

GENUINE BAKELITE DIALS

N931 2 in. Diam. for 3-16 in. shaft..31c
N932 2 in. Diam. for ¼ in. shaft....31c
N933 3 in. Diam. for 3-16 in. shaft..42c
N934 3 in. Diam. for ¼ in. shaft....42c
N935 4 in. Diam. for ¼ in. shaft. Ea.65c

Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

VERNIER DIAL ADJUSTER

N941 Each 14c

Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

SUPERIOR VERNIER ADJUSTER

N942 Each 25c

Polished black knob. "Vernier" engraved in white. Spring adjustment. Need not be disassembled for mounting. Easily installed.

UNIVERNIER CONTROL DIAL

N918 For 3/16 in. shaft, silver dial, black knob $1.10
N919 For ¼ in. shaft, silver dial, black knob $1.10
N916 Gold dial, mahogany knob for ¼ in. shaft. Each.....$1.20

Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

ACCURATUNE CONTROL DIAL

N914 Clockwise...$3.05
N915 Counterclockwise 3.05

Has four inch silver finished dial with black knob. 80 to 1 ratio gives finest tuning adjustment.

BEZELS

Finest quality. Fit any thickness panel.

Size In.	Nickel No.	Price	No.	Price	Gold No.	Price
¾	N904	15c	N907	16c	N910	28c
1	N905	15c	N908	16c	N911	28c
1½	N906	15c	N909	16c	N912	28c

PANEL ENGRAVINGS

N937 Per set 19c

A complete set of transfers in neat white lettering for marking connections, dials, etc. Easily applied in a few seconds. Look like real machine engravings, contrasts neatly on black or mahogany panels. Plenty of titles for the largest set.

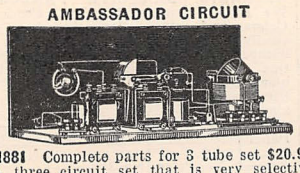
The Barawik Co.
102 So. Canal St. Chicago, Ill.

60,000 Barawik Sets Prove Our Reliability

BARAWIK — VALUE

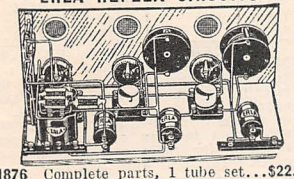
We have many thousands of customers all over the world. You take no risk in dealing with us. We are one of the oldest and most reliable radio supply houses. "RADIO NEWS" guarantees our reliability. Let us serve you and save money for you. All orders shipped same day received.

AMBASSADOR CIRCUIT



N881 Complete parts for 3 tube set $20.95
A three circuit set that is very selective and sensitive and brings in distant stations with excellent volume. Genuine Ambassador tuning coil wound throughout with Litz wire permits sharp tuning. Simple to build and operate. Genuine bakelite panel, size 7x18, drilled ready to mount parts. Complete with instructions for assembling.

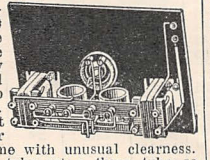
ERLA REFLEX CIRCUITS



N876 Complete parts, 1 tube set...$22.95
N877 Complete parts, 2 tube set... 34.50
N878 Complete parts, 3 tube set... 42.50

These circuits have opened a new field in radio. One tube does the work of three in an ordinary set, two equal four, three equal five. Crystal detector improves quality of reproduction, preserving the full mellow tones of the original. Easily handled, will bring in distance well. All parts are genuine Erla exactly as specified in Erla circuits. Panels are drilled for easy assembly. One tube set has 6x7 panel, two tube 7x14, three tube 7x18.

TWO STAGE AMPLIFIER



N891 Parts complete $10.50
Build a two stage amplifier with the parts we supply and you can add a loud speaker to your one tube set. While low in cost this amplifier gives great volume with unusual clearness. Makes your one tube set a three tube so that all the family can better enjoy the many fine programs that are waiting for you to pick up.

REMLER SUPER-HETERODYNE PARTS

N887 Per Set $22.00
Set includes one oscillator coil, one tuned stage transformer with condenser mountings attached, three intermediate frequency transformers, and wiring diagram.

BRANSTON SUPER-HETERODYNE KIT

N889 Per Set.....$26.50
Contains the special parts necessary for a seven tube Super-Heterodyne set, an oscillator coupler, one tuned stage transformer, three intermediate radio frequency transformers and one antenna coupler. Panel layout and instructions included.

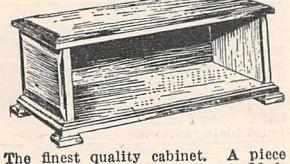
SPIDER WEB COIL FOR REINARTZ CIRCUIT

N296 Each $1.05
A very unusual value. Made of green silk covered wire, spiderweb wound. 21 taps so arranged that crossing avoided. Mounting bracket permits various styles of mounting. Directions included.

COCKADAY PARTS

N298 Per set....$1.65
Complete set coils for Cockaday circuit. Properly calculated and made to give best results in this new wonder circuit.
N276 Amplex grid-denser for Cockaday Improved 5 tube circuit.....$1.10

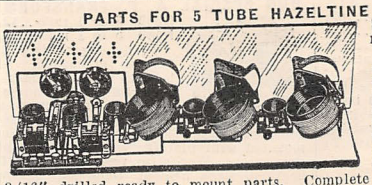
DE LUXE CABINET



The finest quality cabinet. A piece of furniture worthy of the best set. Made of genuine solid walnut in elegant hand rubbed natural walnut or brown mahogany finish. State which is wanted. Top has piano hinge and lid support. Feet at base add to striking appearance. Inside depth 9 inches. Prices quoted on cabinets are not prepaid. Be sure to allow extra for transportation.

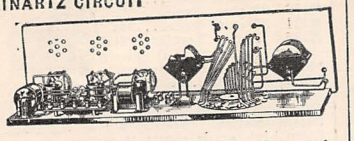
Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
7x18	N444	$7.65	7x26	N447	$10.50
7x21	N445	8.25	7x28	N449	11.50
7x24	N446	8.95	7x36	N448	13.75

PARTS FOR 5 TUBE HAZELTINE NEUTRODYNE CIRCUIT



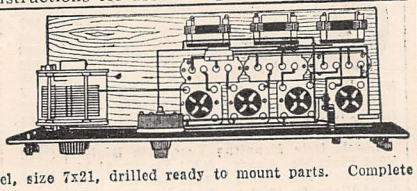
N858 Complete set parts, including mahogany finished cabinet.....$36.50
All the parts needed to build this circuit which is the leader of all circuits today. Tunes thru interference. Easy to find stations once they have been located. Brings in distant stations on the loud speaker in clear pure tones with wonderful volume. Essential parts licensed under Hazeltine patents. Genuine bakelite panel 7x24x 3/16" drilled ready to mount parts. Complete instructions furnished for assembling and wiring. With these parts you can easily build a high grade set at low cost. Note that all our prices are prepaid.

PARTS FOR REINARTZ CIRCUIT



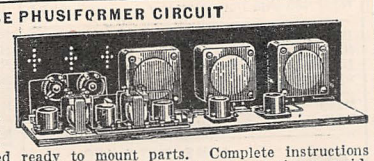
N862 Complete set of parts for one tube set $10.25
N863 Complete set of parts for three tube set $17.50
One of the best circuits for bringing in distant stations. Can be built at very low cost, yet produces fine results. Easy to handle. The three tube provides loud speaker volume on distant stations. One tube set has 7x14 panel, 3 tube set 7x21 panel. Panels are drilled for easy assembly. Complete with instructions for assembling.

ACME REFLEX CIRCUIT



N883 Complete parts for 4 tube set $49.50
One of the most efficient circuits known. Combines three stages of radio frequency and audio frequency using only four tubes. Crystal detector gives unusual clarity. Genuine Acme condenser. Pot Rheo, radio and audio frequency transformers supplied. Genuine bakelite panel, size 7x21, drilled ready to mount parts. Complete with instructions for assembling.

PARTS FOR 5 TUBE PHUSIFORMER CIRCUIT



N880 Complete set of parts, including high grade cabinet.....$41.50
One of the easiest sets to build. Best results assured. Two stages tuned radio frequency amplification detector and two stages audio amplification. Brings in the distant stations with great volume and purest tones. Best grade parts furnished throughout. Genuine bakelite panel 7x26x3/16" drilled ready to mount parts. Complete instructions furnished for wiring and assembling. Note that all our prices are transportation prepaid.

You will be more than pleased with the quality of any goods you buy from us. We do not handle any second grade merchandise. All clean fresh stock in original containers.

MARVELO V
Five Tube Set

The Greatest Radio Value Ever Offered

A five-tube radio frequency set that brings in the distant stations on the loud speaker. All the volume you could want with the finest tone quality, clear and sweet. Careful designing with big quantity production make our low price possible. Only the finest quality materials used throughout. New style efficient low loss condensers and transformers. Bakelite panel size 7x18 in. Handsome mahogany finish cabinet. Neat convenient dials. We can recommend this set for either city or country use. Will not radiate and will bring in stations from coast to coast. No set approaches this set for value. Equals many sets selling at double and triple our price. Try it for ten days. If you are not satisfied return it and we will refund your money.

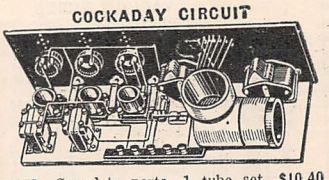
N867 Set only $47.50

N868 Set complete with five genuine UV201A or C301A tubes, 90 volts "B" Battery, 100 ampere storage battery, one N613 Special Speaker, and complete antenna equipment. Nothing extra to buy. Price.....$87.00

N864 Set complete with five genuine UV199 or C299 tubes, 90 volts "B" Battery, three 1½ volt dry cell batteries, one N613 Loud Speaker and complete antenna equipment. Nothing extra to buy. Price.....$77.00

The Barawik Co.
102 So. Canal St. Chicago, Ill.

COCKADAY CIRCUIT

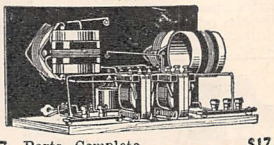


N873 Complete parts, 1 tube set..$10.40
N874 Complete parts, 2 tube set.. 19.75
A very selective set that will tune out even nearby stations. A favorite circuit with many builders. One tube set has 7x14 panel, 3 tube 7x21. Panels are drilled for easy assembly. Instructions furnished for assembly.

IMPROVED COCKADAY CIRCUIT

N875 Complete parts for 5 tube set $48.95
This is the latest model Cockaday circuit with resistance coupled amplifier. Green silk coil wound on bakelite tubing, highest grade grounded rotor low loss condenser and best grade parts throughout. 7x24 panel drilled ready to mount parts. Complete with instructions for assembling.

TWO TUBE HARKNESS REFLEX CIRCUIT



N897 Parts Complete $17.25
This circuit gives excellent volume and long distance with least amount of apparatus and consequently lowest cost. Tunes easily and will equal most four tube sets. Crystal detector provides purest tone quality. An ideal circuit for those looking for maximum results at minimum cost. Complete with 7x14 genuine bakelite panel drilled ready to mount parts and instructions for assembling.

LICENSED NEUTRODYNE PARTS

N852 Licensed Neutrodyne Kit $15.95
Includes three licensed Neutroformers, 2 neutrodons, panel layout, template and book of instructions for building up neutrodyne set. By adding other parts a neutrodyne set can be built at low cost.

TUNED RADIO FREQUENCY UNIT

N853 Each $2.75
Three for 7.85
Consists of radio frequency transformer wound on bakelite tubing and high grade variable condenser. For use in tuned radio frequency circuits. Usually used in sets of three. Condenser shaft ¼" diam.

BALANCING CONDENSERS

N854 Pair 70c
Sold in pairs for neutralizing the capacity in two-stage radio frequency circuits.

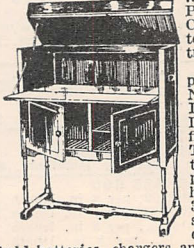
PHUSIFORMER

N546 Each $6.85
A new device especially designed for tuned radio frequency circuits. Consists of primary and secondary inductively coupled coils connected with variable condenser, all enclosed in moulded case with binding posts. Dial on shaft of condenser. Size 4½ in. square, 2 in. thick. Three units occupy small space and can be used to make up a very efficient 5 tube set at low cost.

COILS FOR POPULAR CIRCUITS

N295 Harkness Coils. Pair.....$1.90
N297 Ultra Audion Coil. Each.... .80
N563 Superdyne Coils. Set..... 3.45
N557 Filter Circuit Coils. Set.... 2.78

CONSOLE RADIO CABINET



N902 Each $37.50
Price is F.O.B. Chicago. Be sure to allow extra for transportation.
A high grade piece of furniture. Neat appearance. Elegant finish. Looks well among finest furnishings. Top compartment takes any set or panel size 9 in. high, 10 in. deep, 33 in. long or smaller. Lower compartments hold batteries, chargers and all accessories. Can be entirely closed and locked. Strong durable construction. Paneled doors. Fine mahogany or walnut finish. Size over all, 37 in. wide, 14 in. deep, 42 in. high.

BARAWIK

Prices Now are Lower than Ever Before

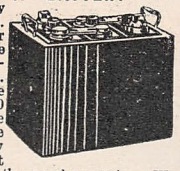
QUALITY

We Pay Transportation Charges in U. S. East of the Rockies on All Items Except Batteries, Panels and Cabinets. The Prices Quoted Deliver the Goods to Your Door

ALL ORDERS SHIPPED SAME DAY RECEIVED

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid

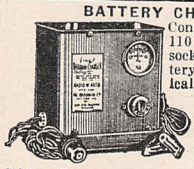
STORAGE "A" BATTERY



The best battery buy on the market. Guaranteed for three years. Made of best new materials. Full capacity. Try one of these batteries for 10 days. If at the end of that time you are not fully satisfied return it and we will refund the purchase price. We save money for you on these high grade batteries. Prices quoted are F.O.B. Chicago or Philadelphia.

N194 6 volt, 60 amp. size. Each..$9.85
N196 6 volt, 100 amp. size. Each..13.25

BATTERY CHARGER



Connect charger to 110 volt 60 cycle light socket and your battery charges automatically over night at a cost of only a few cents. Cord and clips for connections included.

N201 For 6 volt battery.....$12.95
N203 For 12 volt battery..... 12.95

STANDARD BRAND BATTERY CHARGING RECTIFIERS

N207 Balkite $18.50
N206 France Super Charger..... 19.50

Noiseless Bulb Type Chargers.

King, Tungar or Rectigon. Complete with bulb.

N255 2 amp. $15.95 N256 5 amp. $25.25

Extra Bulbs.

N257 2 amp. $3.65 N258 5 amp. $7.00

HYDROMETER

N190 Each 48c
Helps keep battery in better shape by showing exact condition.

BATTERY CLIPS

N198 Two for 28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

"A" BATTERY CORDS

N191 Per pair 72c
Two heavy insulated stranded copper wires 5 feet long. Battery clip on one end and binding post terminal on other end. Eliminate shorting of "A" battery. Provide positive connections.

CONNECTING CORD SET

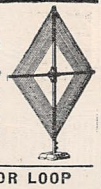
N192 Each 60c
Five connecting cords with braid over all. Each cord has distinctive colored covering. Terminals for connections. Makes connecting of both A and B batteries to set easy with no mistakes in polarity or voltage. Will reach from table to floor or for use in any type cabinet. Does away with unsightly wires. This is a $1.00 retail value.

B BATTERY ELIMINATORS

One of the most recent radio developments. No B Batteries required when a device of this type is used. Can be used only on 110 volt 60 cycle alternating current.

N167 Dubilier. Complete with rectifying bulb. $41.00
N157 Timmons. Requires one 201A tube. Tube not included $32.00
N158 Balkite. No bulb required...$49.50

COLLAPSIBLE LOOP ANTENNA



N976 Each $3.80
A full size loop antenna 31 in. high 28 in. wide. Folds into compact case 18 in. long, 3 in. diam. Well made. Fine looking. Insulated wire, extra flexible. Suitable for use with any loop set. Case included. Quickly set up or taken down.

LITZENDRAHT WIRE FOR LOOP ANTENNA

N977 Per 100 feet.....75c
Composed of sixty strands of No. 38 copper wire and five strands of No. 36 phosphor bronze wire covered with a double service maroon cotton. The ideal wire for loops and other special types of antenna. Looks well, will not stretch and holds its shape.

LIGHT SOCKET ANTENNA

N978 Each 97c
Screws into any light socket. Replaces the regular out door antenna. Very satisfactory for nearby stations and under favorable conditions will bring in distant stations. Easy to install. No danger. Gives clear reception with little static interference. Ideal for people in apartment buildings.

FAHNESTOCK CONNECTORS

N366 Single Connector. Dozen 16c
N367 Double Connector, Dozen 38c
N368 Antenna Connector. Each ...9c

N613 Special Sale Price.....$5.95
This speaker is a marvel for volume and quality of tone. It is actually superior to most of the higher priced speakers and at our price is the biggest value on the market. Guaranteed to please you. Beautiful mottled black finished fiber horn. Bell diameter 10 inches. Height 21 inches. Complete with cord.

BARAWIK QUALITY HEADSET

N770 Spec. Price per Set..$2.28
These headsets are the very best for tone quality and volume. Finest quality. Designed to sell for much higher prices than we ask and at our price are a wonderful bargain. Receiver cases are fine polished black finish. Comfortable fabric covered head band. Complete with 5 foot cord.

CABINET TYPE LOUD SPEAKER

N605 Prepaid price, each $17.50
A fine loud-speaker with a full rich tone and unusual volume. Amplifying chamber and genuine Baldwin unit enclosed in fine mahogany finished cabinet with silk backed grille front. Very convenient and better looking than most other types of speakers. A wonderful value at our price, in our opinion equal to other speakers sold at double our price.

STANDARD BRAND LOUD SPEAKERS AND UNITS

N618	Brandes Table Talker	$8.45
N610	Frost Musette	10.75
N616	Atlas Loudspeaker	21.95
N620	Baldwin Loud Speaker	19.50
N603	Magnavox M4 Loudspeaker	21.95
N612	Magnavox R3 Loudspeaker	31.75
N614	Magnavox M1 Loudspeaker	26.50
N757	Morrison Adjustable Unit	4.35
N755	Genuine Baldwin Type C unit	4.85
N608	Atlas Unit. Each	10.80

BALDWIN LOUD SPEAKER UNIT WITH PHONOGRAPH ATTACHMENT

N602 Each $8.25
Make a loud speaker of your phonograph. These attachments consist of a high grade speaker unit arranged to attach to tone arm of phonograph in place of a reproducer. Fit Victor, Sonora, Silvertone and other phonographs having same size tone arm.

ANTENNA MAST FITTINGS

N952 For ½ inch pipe. Per set $1.00
N953 For 1 inch pipe. Per set $3.35
Set includes adjustable base to fit roof peak or flat surface, center guy wire fastening ring and top cap with pulley for rope to raise and lower antenna. No pipe included. Makes the installation of a first class antenna simple and inexpensive.

ANTENNA OUTFIT

N272 Each $2.65
Consists of 150 feet stranded copper antenna cable, lightning arrester, four wall insulators, two antenna insulators, antenna lead-in, 25 feet insulated ground wire, ground clamp and 25 feet connecting wire.

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.

N248 100 ft. coil 53c N249 500 ft. coil $2.45

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments. Size 14.

N240 100 ft. coil 49c N242 500 ft. coil $2.35

SUPERIOR LIGHTNING ARRESTER

N982 Each 42c
Porcelain block with brass binding posts. Dependable and effective.

STANDARD BRAND HEADSETS

N754	Baldwin Type C	$9.80
N764	Frost, 2000 ohm	3.50
N766	Frost, 3000 ohm	4.35
N751	Murdock 56, 2000 ohm	3.25
N752	Murdock 56, 3000 ohm	3.60
N768	Brandes Superior, 2000 ohm	4.85
N769	Brandes Navy, 3000 ohm	6.85

PHONE CUSHIONS

N774 Pair 40c
Made of soft sponge rubber. Light as a feather. Fit any phones. Exclude all noises and make wearing phones a pleasure.

EXTENSION CORDS

N403 30 ft. $2.15
Place loud speaker wherever desired without moving set. Consists of high grade receiver cord of length specified with plug on one end and jack on other to take plug on loud speaker cord.
N404 30 ft. cord only.....$1.30
N405 Extension jack only..... .69

PHONOGRAPH ADAPTERS

N771 Fits single unit to tone arm. Each 39c
N773 Fits any double headset to tone arm. Each...65c
Convert your phonograph into a loud speaker. Take off the reproducer and replace with adapter and unit or headset. Such a combination will equal or surpass in tone and volume many high priced speakers.

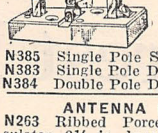
ANTENNA LEAD-IN

N259 .....17c
Antenna wire is brought in without drilling a hole. Place on window sill and window can be closed down tight and locked as before. Well insulated. Can be bent into any shape. Made of copper strip properly insulated.

WALL MOUNTING INSULATOR

N262 2 for 16c
Dozen 78c
Galvanized screw mounting
Lead-in wire passes through center of porcelain insulator and is kept away from possible grounds. Easily installed.

PORCELAIN BASE SWITCHES



Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.

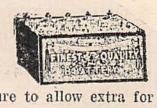
N385 Single Pole Single Throw. Ea...20c
N383 Single Pole Double Throw. Ea...26c
N384 Double Pole Double Throw. Ea...44c

ANTENNA INSULATORS

N263 Ribbed Porcelain insulator, 2½ in. long, 2 for 12c
Dozen 48c
N265 Ribbed Porcelain insulator—5 inches long, 2 for 28c

N263

PLATE CIRCUIT "B" BATTERIES



Reduced prices. A leading standard brand advertised to sell at much higher prices. No better battery made. Longest service. Prices quoted are F.O.B. Chicago. Be sure to allow extra for postage.

N180 Small size 2 by 2½ by 3¾ in. 22½ volts. Each .....90c. Ten for $8.60
N184 Large size, 5 taps. Size 3x4x6½", 22½ volts. Each...$1.55. Ten for...$14.70
N188 Large size, 6 taps. Size 3x8x6½", 45 volts. Each...$2.75. Ten for ...$27.90

N181 22½ volt. New upright size 3x2½x5½ in. Takes less space in set. Each.....$1.45
N183 45 volt upright size 3x7x 8 in. Each $3.10. Ten for $27.90

"C" BATTERY

N186 4½ volt C battery size 4x 1¾x3". Ea. 38c. Ten for...$3.69

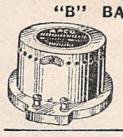
BATTERY METERS

N189 Each 85c
Reads 0 to 50 volts. Accurately tells you condition of "B" Battery. Convenient watch size. Tests 22½ and 45 volt batteries.
N193 Combination meter $1.38
Reads 0-50 volts; 0 to 35 amperes. Tests "B" and "A" dry cells.

STORAGE "B" BATTERIES

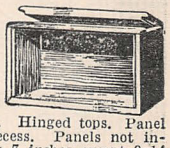
N202 12 cells, 24 volts. Each $3.95
Price is F.O.B. Chicago. Be sure to allow extra for postage.
More economical than dry cell "B" batteries on sets using 3 or more tubes. Can be recharged when run down. Capacity 2500 milliamperes. A high grade battery. Glass jars with rubber caps. Strong moulded tray. Shipped dry so as to be mailable. No Electrolyte included. Electrolyte may be obtained at any drug store or service station. Instruction card tells you what to ask for.

"B" BATTERY CHARGER



N205 Each $8.95
Recharges 24 or 48 volt B batteries from 110 volt 60 cycle light socket rapidly and at practically no cost. Keeps batteries in good condition.

CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Panel fits flush in front recess. Panels not included. Inside depth 7 inches except 9x14 12x14, 12x21, which are 10 in. deep. Prices quoted on cabinets are not prepaid. Be sure to allow extra for transportation.

Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
6x7"	N420	$1.95	7x21"	N425	$3.20
6x10½"	N422	2.45	7x24"	N429	3.40
7x10"	N421	2.60	7x26"	N431	3.50
7x12"	N424	2.85	9x14"	N428	3.55
7x14"	N423	2.95	12x14"	N430	4.00
7x18"	N426	3.65	12x21"	N432	5.05

BASE BOARDS FOR CABINETS

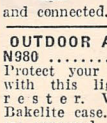
Fasten to bottom of panel and fit inside cabinets. ¾ inch thick, 6½ inches wide.

Art. No.	Length Inches	Price Each	Art. No.	Length Inches	Price Each
N435	6½	19c	N439	17½	29c
N436	9½	23c	N440	20½	31c
N437	11½	25c	N441	23½	33c
N438	13½	27c	N442	25½	39c

GROUND CLAMP

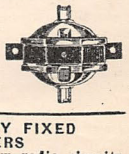
N273 Made of soft copper ⅝" wide with Fahnestock connector. Fits any pipe ⅜ to 1 inch wide. Each.....10c

JEWELL LIGHTNING ARRESTER



N981 Each 85c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved.

OUTDOOR ARRESTER



N980 .....$1.20
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Underwriters approved.

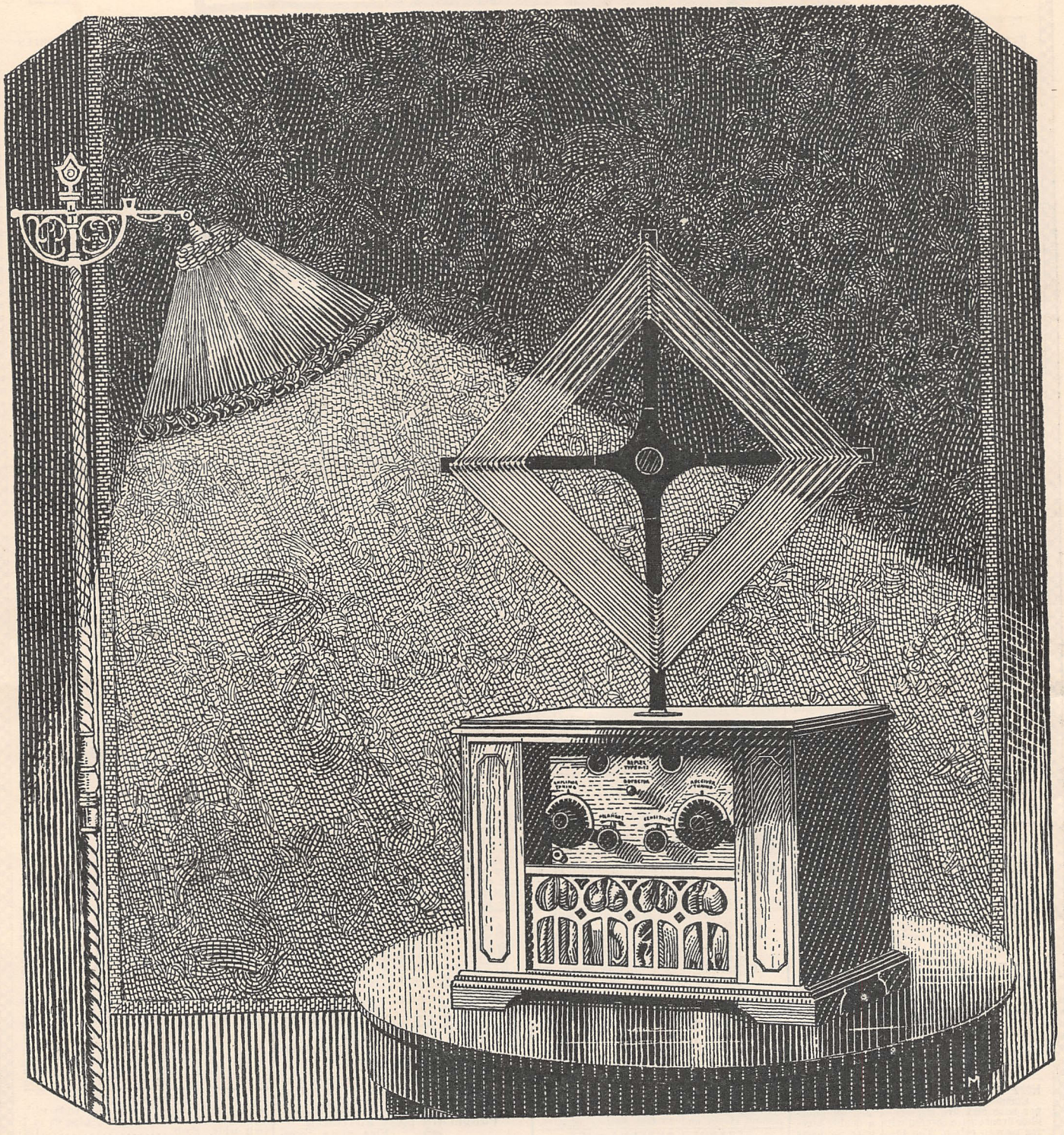
LARGE CAPACITY FIXED CONDENSERS

Tested for use in the new radio circuits. Metal cases. Soldering lugs for connections. Best materials. Carefully made.

N358 .25 mfd...55c N359 .5 mfd. $.65
N360 1 mfd...85c N361 2 mfd...1.35

The Barawik Co.
102 So. Canal St. Chicago, Ill.

You have



De Forest Radiophone

Requires no aerial—no ground wire

DeForest Loud Speaker and Tubes complete within cabinet.

Ready to operate within 5 minutes after delivery.

Easily movable from room to room.

the radio habit now!

You'd better have a De Forest!

WHETHER you have an instrument or not, whether you know it or not, you have the radio habit already. Do you go to the theatre? Do you go to political meetings? Do you read the day's news? Do you seek contact with people who offer either amusement or information? Then you're essentially a radio fan, for many of the best of these things radio is giving in a way that they cannot be obtained elsewhere.

Here is what De Forest is doing for radio.

The De Forest Radiophone is a complete and self-contained instrument with a loop the size of a picture frame instead of an aerial wire, with batteries self-contained.

It can be easily moved from room to room. It has a remarkable tone quality. It brings out the voice or instrument as sincerely and truthfully as the performer himself does—and clears itself (with the right dial settings) from disturbing or metallic noises. And it is an immediate result-getter that is simple to operate.

Whatever there is in radio, De Forest can give it to you. It yields good results from the beginning and gradually increasing results as your skill grows. *There is nothing else like it.*

DV-2

***Your Tubes* are the key to your radio reception**

IF you know what the tubes do in a radio set, you'll know why nothing but De Forest Tubes will do.

USED as detectors or amplifiers, these tubes combine ideal operation with long life, sturdy strength and freedom from microphonic noises.

DV-2, for storage batteries, requires a filament potential of 4½ volts, and has a current consumption of 25/100 of an ampere.

DV-3, for dry batteries, requires 3 volts on the filament, and consumes 6/100 of an ampere.

DV-3

The "Magic Lamp" of Radio

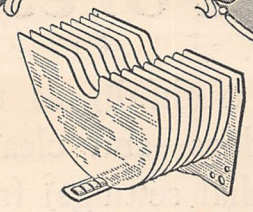
It will pay you to look up a De Forest agent

He is willing and equipped to teach you the simple technique of using the De Forest. Let him demonstrate it in your own home.

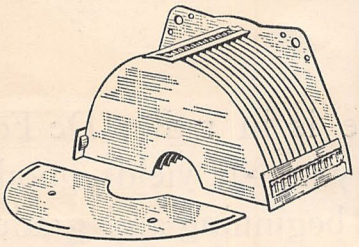
DE FOREST RADIO CO.
Jersey City, N. J.

DE FOREST
REG. U.S. PAT. OFF.
RADIOPHONE
REG. U.S. PAT. OFF.

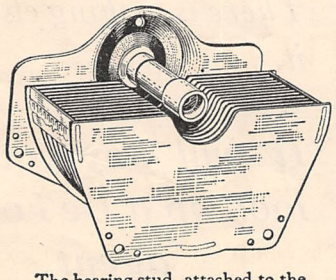
Making the New Bradleydenser



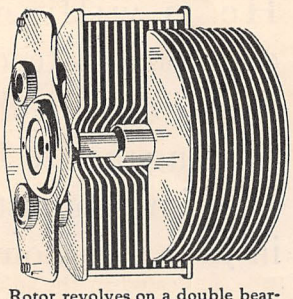
The brass stator plates are soldered to notched spacer bars that maintain perfect alignment.



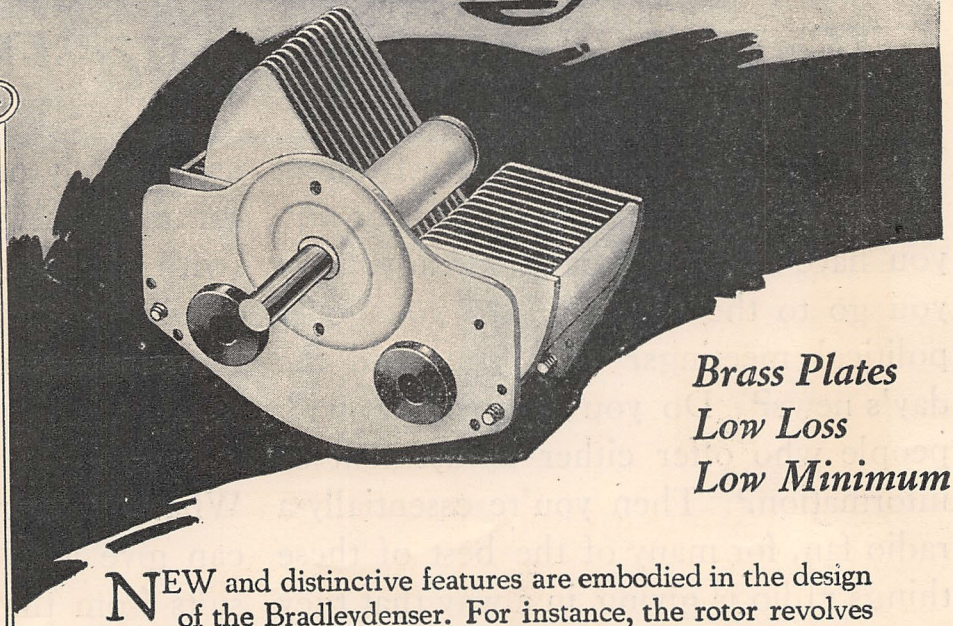
Plates, spacer bars and end plates are all soldered into a solid unit.



The bearing stud, attached to the stator mounting plate, supports the rotor. See illustration at bottom of this page.



Rotor revolves on a double bearing that is independent of the dial shaft.



Brass Plates
Low Loss
Low Minimum

NEW and distinctive features are embodied in the design of the Bradleydenser. For instance, the rotor revolves on a long double bearing that preserves rigid alignment and yet eliminates the extra outer end-plate. This reduces the amount of di-electric material and increases the efficiency.

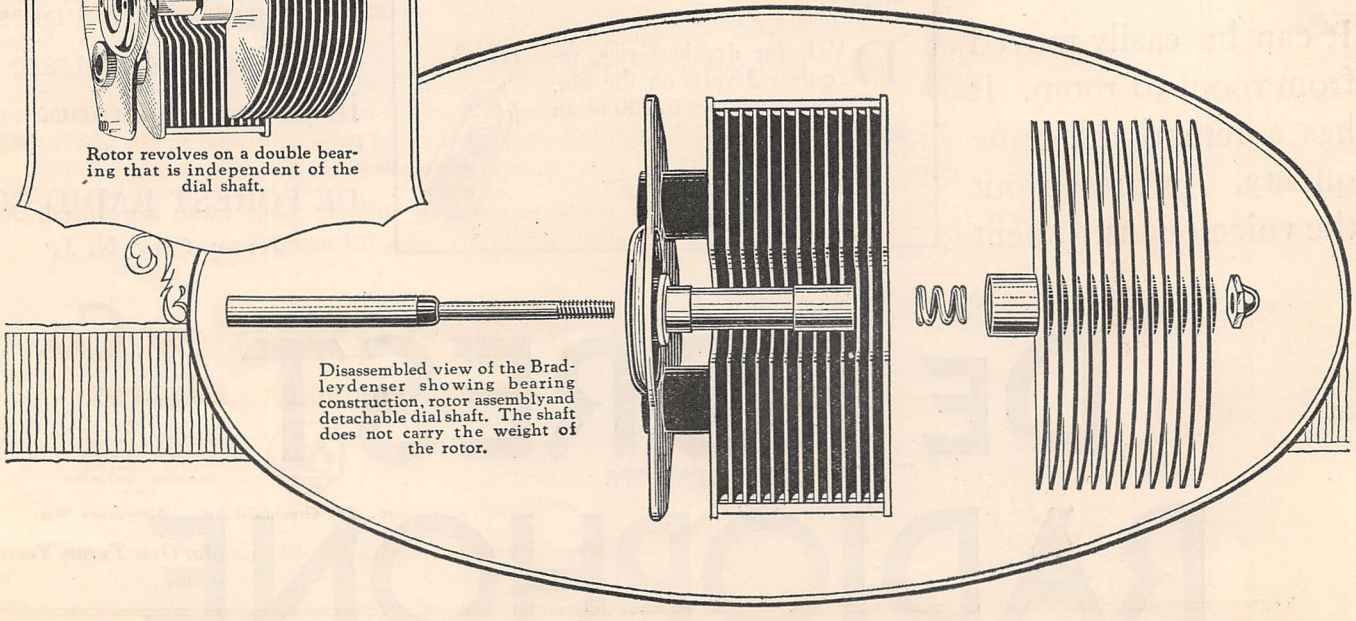
Every joint is soldered. This, combined with the use of brass plates, further increases the operating efficiency. Another feature is the dust cap over the stator plates; it is removable without tools.

The Bradleydenser is made in four sizes: 0.00025 M-f. at $4.50; 0.00035 M-f. at $4.75; 0.0005 M-f. at $5.00; and 0.001 M-f. at $6.00. Leading radio dealers are showing them, now.

Allen-Bradley Co.
Electric Controlling Apparatus

287 Greenfield Avenue MILWAUKEE, WIS.

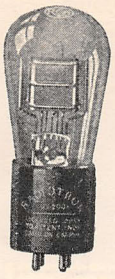
Manufacturers of Electric Controlling Apparatus for Over Twenty Years



Disassembled view of the Bradleydenser showing bearing construction, rotor assembly and detachable dial shaft. The shaft does not carry the weight of the rotor.

Use Any Tube

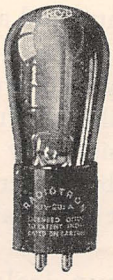
UV-200 or C-300



Volts—5
Amps.—1
Grid Leak
0.5—2
Megohms
Condenser
.00025
.0005 M-f.

UV-201A or C-301A

Volts—5
Amps.—.25
Grid Leak
2—9
Megohms
Condenser
.00025 M-f.



WD-12 or C-12

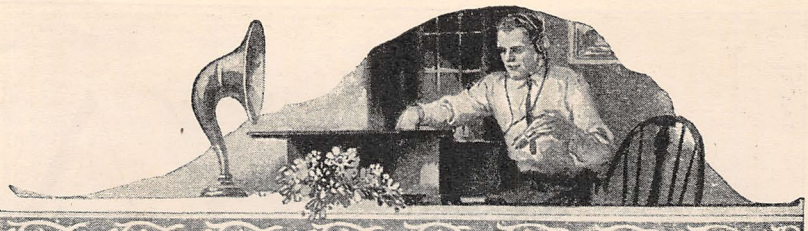
Volts—1.1
Amps.—.25
Grid Leak
2—3
Megohms
Condenser
.00025 M-f.

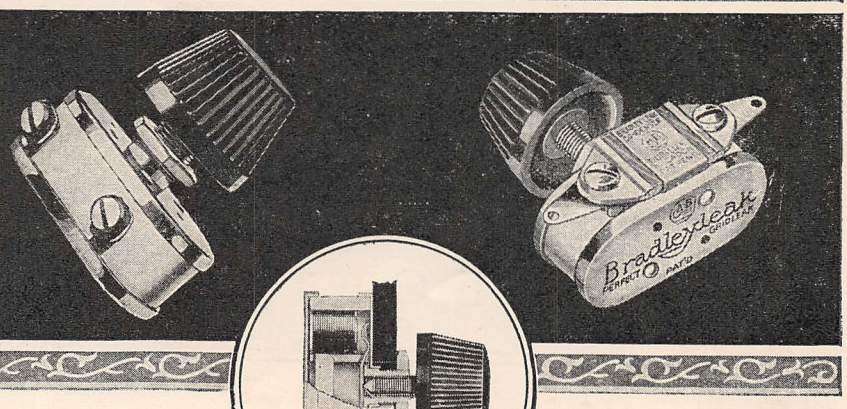
WD-11 or C-11

Volts—1.1
Amps.—.25
Grid Leak
2—3
Megohms
Condenser
.00025 M-f.

UV-199 or C-299

Volts—3
Amps.—.06
Grid Leak
2—9
Megohms
Condenser
.00025 M-f.





Bradleystat
PERFECT FILAMENT CONTROL

Bradleyleak
THE PERFECT GRID LEAK

Do You Know—

that any tube can be used in your set without changing rheostats or grid leaks?

IT SOUNDS unbelievable, but it's true. The perplexing problem of selecting the correct rheostat or grid leak is solved by using the Bradleystat and the Bradleyleak. They offer the most marvelous range without steps or noise, and such smooth precision of control that no other rheostat or grid leak can approach them in performance.

The Bradleystat has a resistance range from approximately ¼ to 100 ohms, by merely turning the adjusting knob that varies the pressure on the graphite discs. It will handle *all tubes* without change of connections, and provide ample control in every case.

The Bradleyleak, with a range from ¼ to 10 megohms, can be adjusted instantly for any tube, indicated in the adjoining table of tube ratings, by turning the adjusting knob.

Be ready to use any tube in your radio set. Install Allen-Bradley Radio Devices, throughout.

Have you used the Bradleyswitch? It saves batteries and tubes.

Allen-Bradley Co.

ELECTRIC CONTROLLING APPARATUS

Sales Offices:
Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit

Sales Offices:
Knoxville, Los Angeles, New York, Philadelphia, Pittsburgh, Saint Louis, Saint Paul, San Francisco, Seattle

General Offices and Factory: 287 Greenfield Ave. Milwaukee, Wis.

Manufacturers of Graphite Disc Rheostats for Over Twenty Years

ATWATER KENT

RECEIVING SETS

CONFIDENCE characterizes the attitude of all ATWATER KENT owners—Dependable performance, day in and day out, has brought to them a new realization of radio efficiency; a new meaning of the words Selectivity, Sensitiveness, Distance and Volume.

With an ATWATER KENT, everyone in the family can easily obtain perfect results. It gives instant command of any program on the air—it is a library, a concert stage, a theatre and a newspaper all in one.

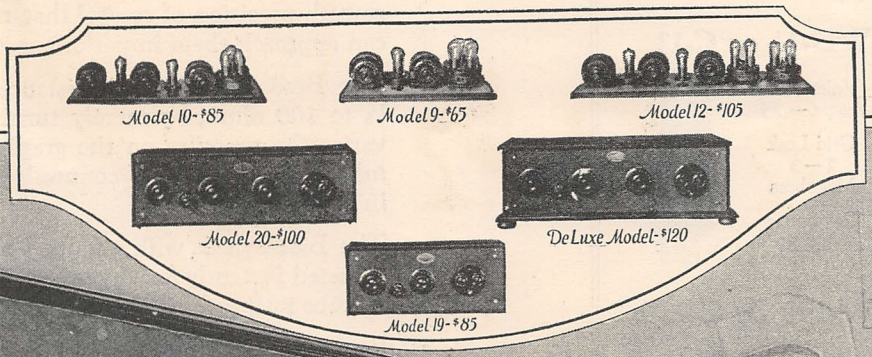
The knowledge of over a quarter century's experience is built into ATWATER KENT Radio. It is designed by skilled engineers and made by master workmen from the finest materials that money can buy.

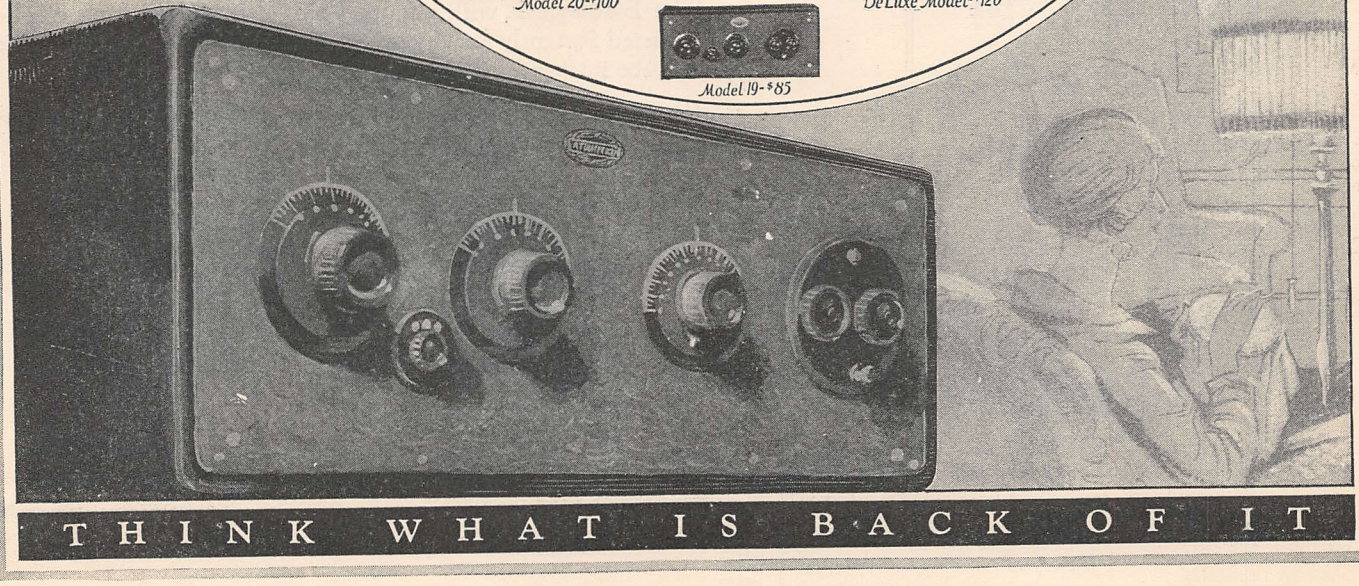
Any ATWATER KENT dealer will prove to you through a demonstration that here are the instruments that will meet all your expectations.

Interesting literature on request

ATWATER KENT MANUFACTURING COMPANY, *4713 Wissahickon Ave.*, Philadelphia, Pa.

Pacific Coast Prices slightly higher





THINK WHAT IS BACK OF IT

ATWATER KENT

LOUD SPEAKERS

THE ATWATER KENT Loud Speaker brings out the best from any set.

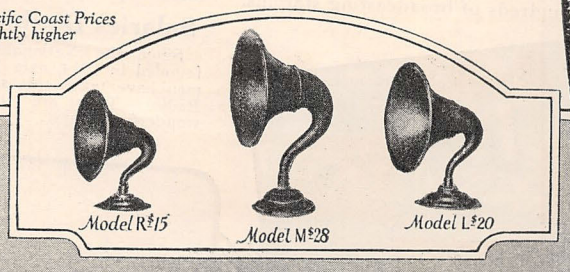
No matter how perfectly your receiver may bring in the wonderful programs that are in the air, unless your reproducer faithfully re-creates them you cannot get the true spirit and beauty of the broadcasts.

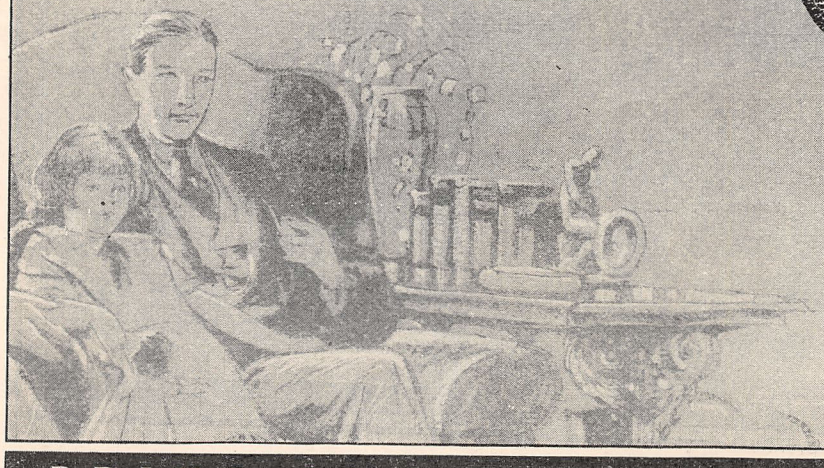
The ATWATER KENT Loud Speaker is the final touch to radio enjoyment. Through it, programs from far and near will fill your home in all their living beauty. It re-creates voice and music so natural in tone, so mellow and generous in volume that it seems not like a reproduction, but the original—just as the broadcasting artists produced it.

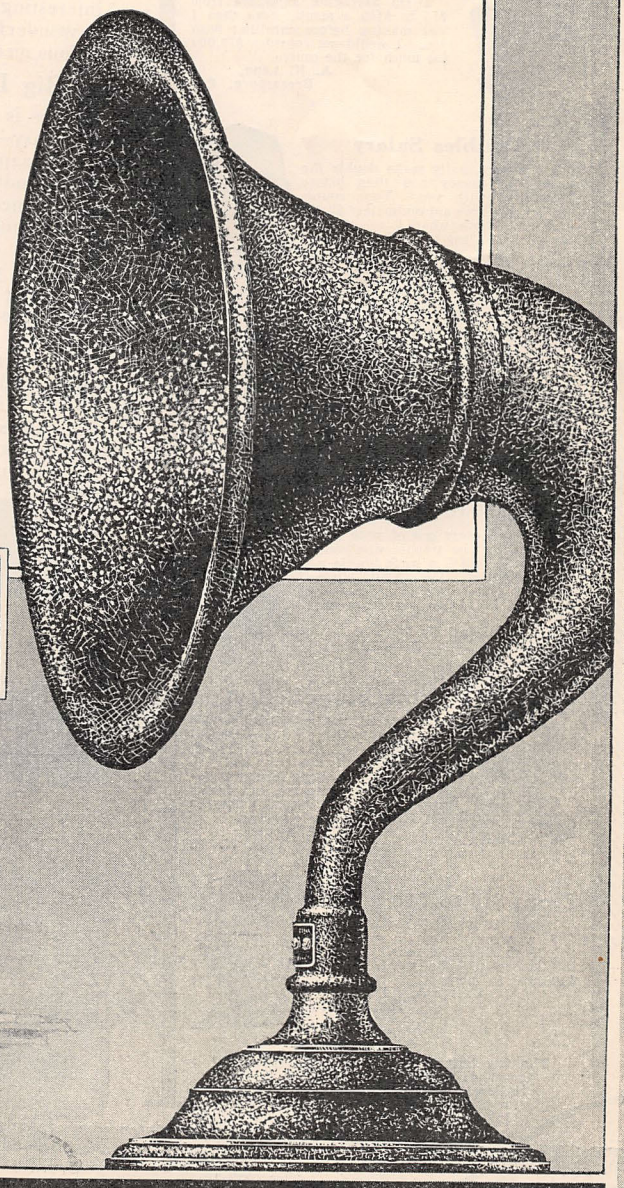
Interesting literature on request

ATWATER KENT MANUFACTURING COMPANY
4713 Wissahickon Ave., Philadelphia, Pa.

Pacific Coast Prices slightly higher







BRING OUT THE BEST FROM ANY SET

How YOU $50 to $200 a

PROOF

Pay Increases Over $100 a Month

I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course.

A. N. Long,
Greensburg, Pa.

Doubles Salary

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it.

T. Winder,
Grand Junction, Colo.

$405 in One Month

I sure have been coining the dough. I never will regret the money I paid for your course. I cleaned up $405 in one month recently. Not so bad—is it—for a fellow who just completed your course a short time ago.

Emmet Welch,
Peculiar, Mo.

Earns $50 to $83 a Week

I enjoyed every one of your lessons and had no trouble whatever. I earn $50 to $83 a week beside a commission on sales. Your course not only enabled me to get bigger pay, but broadened my education as well.

Michael De Marco,
Boston, Mass.

Earns College Education

I entered the maritime service of the Radio Corporation of America and served several months on board ship. I not only had the advantages of visiting foreign countries at no cost to me, but I was also able to save enough money to pay for my tuition to college.

G. E. Rogers,
Troy, N. Y.

From $15 to $80 a Week

Before I enrolled I was making $15 a week. Now I earn from $2,080 to $4,420 a year. I believe the course will be worth at least $100,000 to me.

George A. Adams,
Tamaqua, Pa.

The few letters printed here are typical of thousands received from students of the National Radio Institute. They tell in the language of increased earning what Radio can mean to you.

Hundreds of ambitious men are already earning thousands in this wonderful new industry—you, too, can get your share

The amazing expansion of Radio has opened up hundreds of wonderful new positions on land and sea. Big salaries, interesting, easy work, short hours, and a wonderful future are offered to ambitious men who get into Radio now.

Big Demand for Experts

Here is work that is fascinating, new and easy—an industry which is growing more rapidly than any other in the world today—an industry that offers you the chance of a lifetime to "get in on the ground floor" and make big money. Millions of dollars were spent during the past year on Radio, and thousands of young men are needed right now to meet the ever increasing demand of work.

Men are needed to build, sell and install Radio sets—to design, test, repair—as radio engineers and executives—as operators at land stations and on ships traveling the world over—as operators at the hundreds of broadcasting stations. And these are just a few of the wonderful opportunities.

Stay Home—N. R. I. Brings Training To You

You can easily and quickly qualify in your spare time at home through the help of the National Radio Institute, first school to teach radio successfully by mail. No previous experience or training needed. Prominent Radio experts will help you in every problem, giving you personal attention.

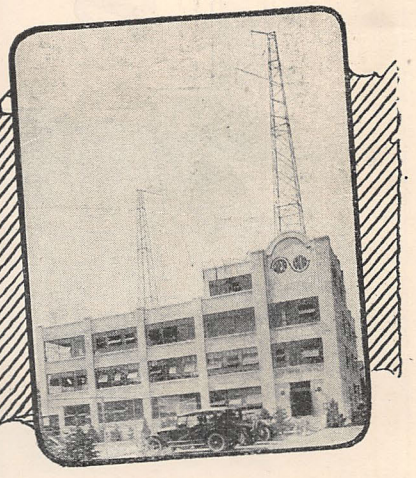
Radio Parts FREE!

You learn by actually doing, as we furnish free with the course circuits and valuable parts for building latest receiving sets, making the work thoroughly practical. You learn quickly and easily—right at home.

This is an absolutely complete course which qualifies you for the real "big pay jobs" in Radio and our big employment department helps you get one.

Salaries Doubled and Tripled

Since the National Radio Institute was founded in 1914, over 15,000 men and young men have taken this short-cut to Success in Radio. They are enthusiastic about this wonderful Course.



Can Earn Week in RADIO

E. W. Barnes, Norfolk, Va., writes: "During my spare time I made about as much repairing radio sets and building them as my regular salary."

In a letter from Arthur Ruse, of Toronto, we read that he has doubled his income since mastering Radio and that he earns from $50 to $100 a month in his spare time.

Letters like these are the best proof of the merit of the National Radio Institute course.

Employers Sending Urgent Calls For Men

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer"—"We want men with executive ability in addition to radio knowledge to become our local managers"—"We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating easy work—a chance to travel and see the world if you care to or to take any one of the many radio positions all around you at home.

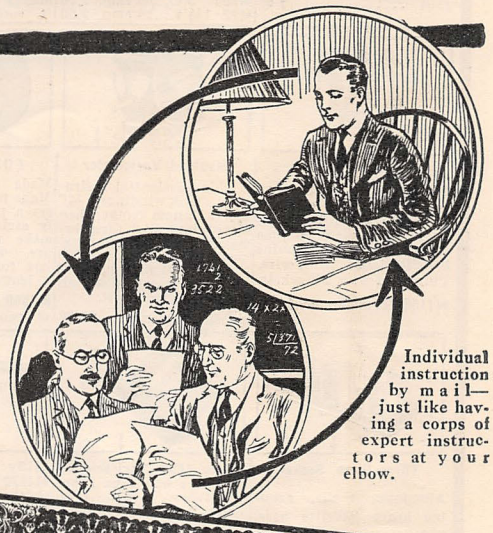
Send For FREE BOOK Mail Coupon Below

Learn more about this tremendous new field and its remarkable opportunities. Learn how you can quickly become a radio expert and make big money in Radio.

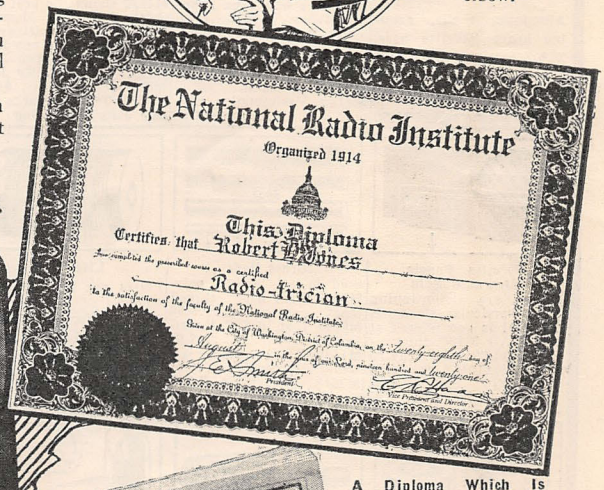
We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing practical training in detail. This Free Book, "Rich Rewards in Radio," will be sent to you without the slightest obligation. Mail coupon for it *now!*

For a short time we are offering a reduced rate to those who enroll at once. Act promptly and save money.

NATIONAL RADIO INSTITUTE
Dept. 13EB Washington, D. C.

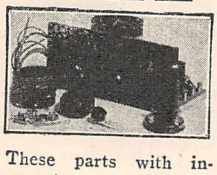


Individual instruction by mail—just like having a corps of expert instructors at your elbow.

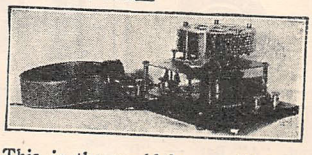


A Diploma Which Is Your Introduction to Radio Jobs on Land or Sea.

FREE FOR PRACTICAL TRAINING AT HOME



These parts with instructions are given for experience and practical training in making and operating regenerative receiving apparatus.



This is the world-famous Natrometer—one of the three instruments given for scientific and practical home training in mastering the code.

These parts with complete instructions are given for practice in building a receiving set of the more simple kind.

NATIONAL RADIO INSTITUTE,
Dept. 13EB, Washington, D. C.

Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special Free Employment Service. Please write plainly.

Name .....Age .....

Address .....Occupation .....

City .....State .....

"BUILD YOUR OWN" WITH "RASCO" PARTS!

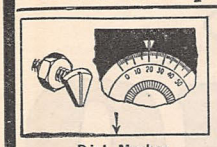
Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page.

SPECIAL PRICES FOR THIS MONTH

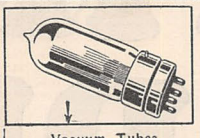
Money refunded if goods do not satisfy



Dial Marker

The big little thing you have been waiting for. Just drill a hole in the panel and mount the marker above the dial. Nickel plated and polished.

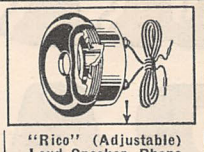
M7788 Dial Marker, each ..... $.05



Vacuum Tubes

Only best make tubes carried in stock. Any tube replaced if defective, providing filament lights.

M701A 5 v., .25 amp. $2.50
M799 3 v., .06 amp. 2.50
M72 1½ v., .25 amp. 2.50



"Rico" (Adjustable) Loud-Speaker Phone

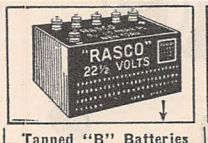
Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification.

M2525 Speaker with 5 ft. cord $2.65

Cockaday Coil

Guaranteed best make. Three windings of No. 18 Magnet wire. Has brass brackets for panel or base mounting. Satisfaction guaranteed or money back.

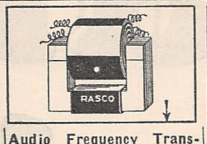
M2750 Cockaday coil $1.50



Tapped "B" Batteries

We positively guarantee these batteries to be of long life. We carry only fresh stocks. All with taps.

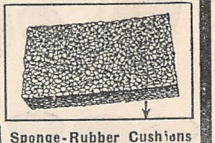
M2250 Sm. 22½ v. .$.85
M2251 Medium Navy size, 22½ volt..... 1.20
M4500 Medium size, 45 volt 2.30



Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.

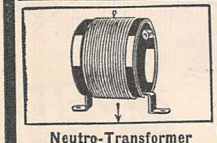
M1100 Ratio 4½-1..$2.00
M1150 Ratio 6½-1.. 2.00



Sponge-Rubber Cushions

Get rid of tube noises due to vibration. Softest sponge rubber made. Size 2½"x3", ⅜" thick.

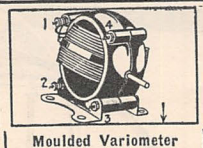
M8989 Sponge-rubber cushions, each ..... $.12
Six for ..... .60



Neutro-Transformer

Can be used for all tuned radio frequency circuits. Made for usual broadcast waves. Secondary has one center tap. Two genuine bakelite tubes. Silk wire. Furnished with 2 brackets.

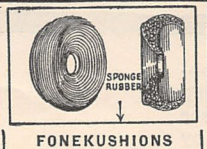
W1159 Transformer $1.65



Moulded Variometer

Highly substantial instrument. Silk windings. ¼" shaft. Bottom flange when placed into 4, 3 direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.

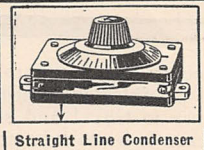
M5350 Variometer..$3.00



FONEKUSHIONS

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.

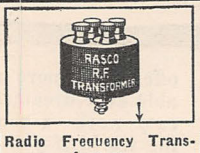
M3550 Fonekushions, set of two ..... $.42



Straight Line Condenser

Simplest and most practical type of condenser.

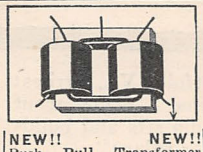
M4430 "Rico" Condenser .001 mfd. 43 plate capacity $1.75
M4230 .0005 mfd. 23 plate capacity $1.75
M4110 .00025 mfd. 11 plate capacity $1.75
All types no dials $1.50



Radio Frequency Transformers

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type. 200-600 meters.

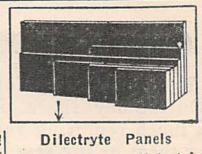
M2800 Transformer, size 1⅞"x2½" $1.50



NEW!! NEW!!

Push Pull Transformer for many new circuits. See any radio magazine. Made of best materials. Coils impregnated. Silicon steel laminations. Save 50 per cent by assembling yourself. Simple instructions furnished.

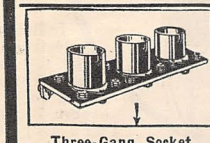
M1159 Push-Pull Transformer, ratio 6½ to 1 $4.00



Dilectryte Panels

Highest dielectric strength as per Bureau of Standards. Beautiful high finish.

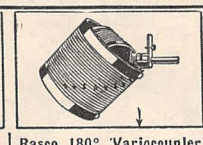
M7100 7x10x3-16"...$.70
M7120 7x12x3-16"... .85
M7140 7x14x3-16"... .95
M7180 7x18x3-16"...1.25
M7210 7x21x3-16"...1.45
M7240 7x24x3-16"...1.65



Three-Gang Socket

Aluminum shells, genuine heavy bakelite base, 3 brackets for mounting, 12 nickel binding posts. Length 7¼".

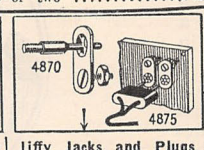
M5995 3 gang socket $1.50



Rasco 180° Variocoupler

Silk wire wound on bakelite tubes. Six taps. Wave length, 150 to 600 meters. For panel mounting. ¼" shaft. Your money refunded if it is not all we claim.

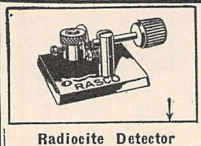
M3100 Variocoupler prepaid $1.50



Jiffy Jacks and Plugs

M4870 shows the best and cheapest cord tip. Mounted behind panel. Positive contact. M4875 shows new Jiffy Cord Plug and two Jiffy Jacks. M4870 Jiffy Jack nut and screw, ea...$0.05
M4875 Two Jiffy Jacks and One Jiffy Cord Plug .20

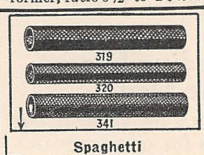
BE SURE TO SEE PAGE 1721 OF "RADIO NEWS" FOR NEW "RASCO" GOODS



Radiocite Detector

Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.

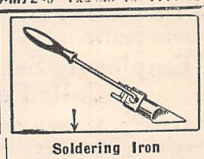
M1899 Detector ...$0.60
M1898 Galena detector ..... $.50



Spaghetti

Varnished flexible cambric tubing, 319 takes No. 22 wire; 320 takes 18 to 20 wire; 321 takes 16 to 18 wire, 341 takes 22 to 28 wire.

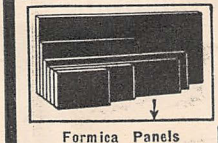
M319-320-321 Per ft. $.06
M341 Flexible soft rubber tubing; 10 feet for..$.20



Soldering Iron

Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.

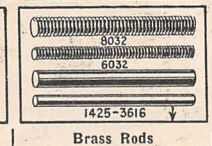
M2200 Soldering iron $1.45



Formica Panels Clearance Sale

As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.

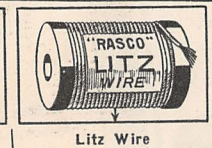
M352 9x12" each....$1.75
M354 6½x19½" ea.. 1.90
M356 6x14" each... 1.60
M357 6x4" each..... .65



Brass Rods

Sold in 6" lengths only.

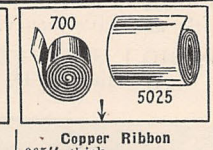
M8032 Rod, 8-32" thread length ..... $.08
M6032 Rod, 6-32" thread length ..... $.06
M1425 Rod, plain ¼" round, length ..... $.10
M3616 Rod, plain 3-16" round, length ..... $.06



Litz Wire

Prices are per foot. E= equals.

M823 E No. 25 B&S $.02
M890 E No. 28 B&S .01
M891 E No. 21 B&S .03
M892 E No. 20 B&S .04
10 per cent discount in 100 foot lots.



Copper Ribbon

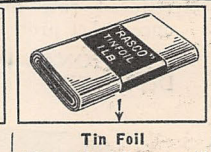
.005" thick.

M700 ¾" wide; M701 ¼" wide; M702 3-16" wide. All sizes per foot...$.01

Copper Foil

.001" thick. 4" wide.

M5025 Copper Foil, per foot ..... $.10
10-foot length ..... .80

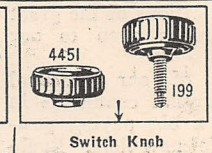


Tin Foil

All our tin foils come 4" wide. Uniform product throughout.

Best grade only M850 has 1500 sq. inches per lb.

M851 700 sq. inches to lb.
M850 Tin foil...lb. $.48
M851 Tin foil...lb. .48

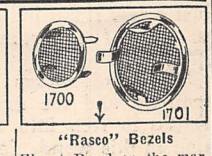


Switch Knob

M199 Knob, 1⅛" dia., height ⅝"; 8-32" screw

M4451 Has 8-32" or 10-32" bushing, no screw.

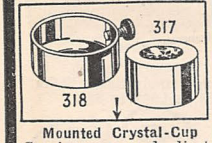
M199 Knob ..... $.10
M4451 Knob ..... .06



"Rasco" Bezels

Finest Bezel on the market. Bezel comes entirely nickel plated. Can be used on ⅛ or 3-16" panel.

M1700 Rasco Bezel, 1 inch ..... $.15
M1701 Bezel, 1½" diam. ..... .20



Mounted Crystal-Cup

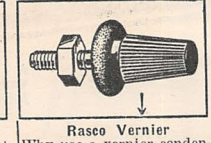
Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.

M318 Nickel Cup....$.20

Radiocite

Best most sensitive mounted crystal. U. S. Navy using it. Each tested.

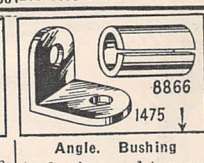
M317 Radiocite Crystal ..... $.25



Rasco Vernier

Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber rim engages dial. Nothing to come apart.

M1450 Vernier..... $.18



Angle. Bushing

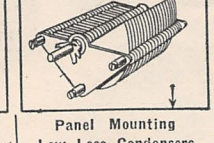
Angle piece used to mount panels, etc. 1,000 uses. 5-16" wide, height 7-16".

M1475 Angle piece, Each ..... $.03

Adapter Bushing

Makes ¼" dial fit 3-16" shaft. ½" long.

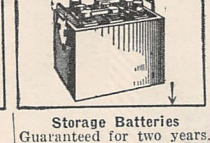
M8866 Bushing..... $.01



Panel Mounting Low Loss Condensers

Positively no better condenser on the market. Shafts ¼". Save from 40 to 60 percent by assembling condenser yourself.

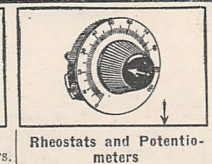
M1111 11 Plate....$1.10
M2121 21 Plate.... 1.22
M4343 43 Plate.... 1.33



Storage Batteries

Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.

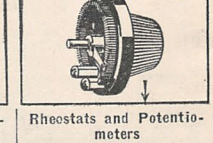
M2400 Two volt, 40 amp. hours $3.90
M640 Six volt, 40 amp. hours 7.25
M666 Six volt, 60 amp. hours 9.50
Shipped express collect.



Rheostats and Potentiometers

Come with metal dials and composition knob. Excellent merchandise despite low price.

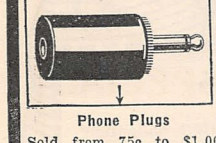
M4210 6 ohm Rheo.$.27
M4211 30 ohm Rheo. .30
M4212 200 ohm Potentiometer ..... .45



Rheostats and Potentiometers

High heat dielectric base. Come with tapered, knurled knob, 2½" dia. Complete with pointer.

M4310 6 ohm .....$.39
M4311 30 ohm ..... .44
M4312 Potentiometer, 200 ohms ..... .65



Phone Plugs

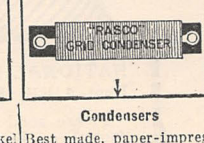
Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship throughout.

M1030 Rasco Telephone Plug. Each .....$.35

Bakelite Socket

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.

M6510 Bakelite socket $.40
M6500 Tube Socket. Made entirely of composition. Best made. Each ....$.35



Condensers

Best made, paper-impregnated condensers. Capacity guaranteed.

M5050 Phone Condenser, .001 ..... $.20
M5056 Grid Condenser, .00025 ..... $.20
M5059 Grid Leak Condenser, .00025..... $.30

Name Plates

All name plates brass with silver letters.

M8389 (Right or left) $.10
M809 Comes in 35 styles. Any denomination, each style ..... $.04
Panel Scale. 2½". 90°. metal, silver background, black lettering.
M715 Scale. Each....$.15

Binding Post Name Plates

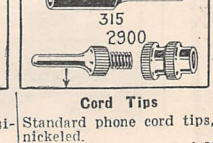
Dia. ¾". These styles: Phones, Ground, —, Output, "A" Bat. —, "B" Bat. —, Loud Speaker, "C" Bat. —, Aerial, +, Input, "A" Bat. +, "B" Bat. +, Loop "C" Bat. +. New! "A" Bat. + "B" Bat. —.

M6000 Name Plates, all styles, each ..... $.03

"Rasco" Posts

Made of black composition.

M650-51 Each..... $.08
M202 Has nickel-plated bottom, each ..... $.08
Dozen, each style....$.90
M122 Initialed Binding Posts. Six popular styles. Each ..... $.06



Cord Tips

Standard phone cord tips, nickeled.

M315 Each ..... $.03

Separable Cord Tips

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.

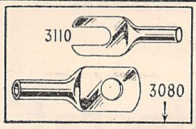
M2900 Each ..... $.06

RADIO SPECIALTY COMPANY, 98 Park Place, New York City

Factories: Brooklyn, N, Y. Elkridge, Md.

"BUILD YOUR OWN" WITH "RASCO" PARTS!

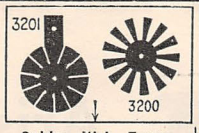
Lowest Prices in America



"Perfect" Lugs

These new and improved lugs are brass, nickel plated, flattened on top as shown. Made of a single piece of metal. Lead wire goes into tube.

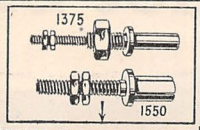
M3110, M3080 "Perfect" Lugs. Each $0.02
Dozen lots ..... .20



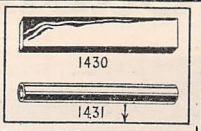
Spider Web Forms

Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. Both 5" diameter.

M3200 Spider form..$.25
M3201 Spider form.. .25



M1375 Universal Bearing to hold rotors. Length of bearing 2¾", shaft 1¼" thread 1" long threaded sleeve ¾" long, each .....$.25
M1550 Sockettes. Four of these take one vacuum tube. Grasp tube firmly. Best by test. Set of 4 $.25

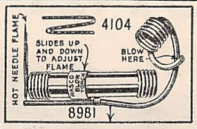


Brass Strip and Tubing

Brass strip ½" wide; 1-16" thick; 6" long.
M1430 Per length....$.10
M1431 Brass tubing, dia. ¼"; 6" long; length $.15

Threaded Brass Rods

Sold in 6" lengths only.
M8032 8-32" thread $.08
M6032 6-32" thread .06

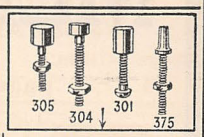


Alcohol Blow Torches

Best made. Give intense hot flame. Great for fine work.
M8981 5" Torch ...$.85
M8982 3" Torch ... .50
M4104 Rosin Core Solder. A non-corrosive solder with flux inside.
18" length .....$.10

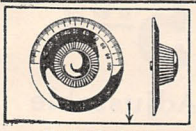
Tropaformer

The only scientific intermediate Super-Heterodyne transformer. It combines transformer and condenser and enables the transformer to be tuned to the finest degree. 3" dial included in price. **M3510** Tropaformer, each $6.75



"Rasco" Switch Points

Nickeled and polished.
M301 ¼"x¼", 6-32", doz. .....$.18
M304 ¼" dia., ½" thick, 6-32", doz.... .18
M305 ¼" dia., 3-16" thick, 4-36", doz.... .18
M375 Switch stop ⅞" long with nut, doz. .. 18

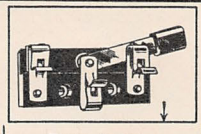


Moulded Dials

Only very best grades handled. Bushings absolutely true. Dials cannot wobble. Letters inlaid in fast white enamel. All dials for ¼" shaft.
M3074 Dial 2" ....$.20
M3075 Dial 3" .... .25
M3076 Dial 4" .... .40

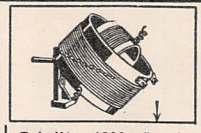
Tuned Radio Freq. Kit

Build your own Neutrodyne or Tuned Radio Frequency Set with this kit. Contains 3 R.F. low-loss coils, 3 low-loss condensers .0005 attached. Also illus. book.
M8778 Radio Frequency Kit $13.85



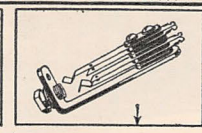
Throw Switches

Mounted on composition block. Small enough for all radio purposes.
M4100 Single Pole..$.25
M4101 Double Throw Single Pole .....$.35



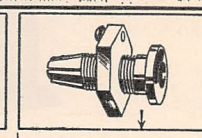
Bakelite 180° Coupler De Luxe Style

Tubes of natural color bakelite, wound with green silk wire. Cast aluminum bracket, ¼" shaft. Primary 13 taps. 180 to 550 meters.
M3150 Coupler $2.35



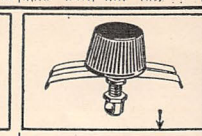
Jacks and Plugs

Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.
M1000 Jack 4 springs $.65
M1001 Jack 3 springs .75
M1002 Jack 5 springs .80
M1003 Plug ..... .35



Cord Tip Jack

Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
M1500 Cord tip jack. Each .....$.15

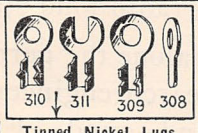


Series Parallel Switch

Quick change from one circuit to another. Black composition knob, nickel plated fittings. Blade radius 1¼".
M2950 Series parallel switch .....$.25

Melotone Loud Speaker

Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
M255 Melotone Speaker $4.00

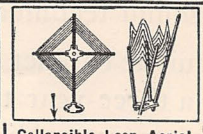


Tinned Nickel Lugs

All our lugs are tinned.
M310 Brass Lugs for No. 8 screw, doz. .....$.10
M311 Copper Lugs for Nos. 6 and 8 screws, doz..$.10
M309 Copper Lugs for Nos. 4, 6 and 8 screws, doz .10
M308 Copper Lug for 6-32 screw. doz. ..... .10

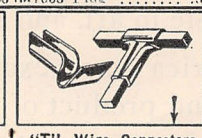
Wood Cabinets

Highest grade mahogany cabinets made. Top is hinged. Made of ½" stock.
M710 Panel, 7x10" $2.60
M712 Panel, 7x12" 3.00
M714 Panel, 7x14" 3.15
M718 Panel, 7x18" 3.40
M721 Panel, 7x21" 3.75
M724 Panel, 7x24" 4.20



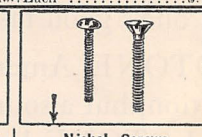
Collapsible Loop Aerial

32" high, 28" wide. Has heavy cast base upon which loop turns easily. Winding consists of special multiple stranded wire. Loop readily folds to fit into 4" tube. Hard rubber insulation. **M2610** Collapsible loop $3.75



"T" Wire Connectors

This big little article solves all troubles when making "T" wire connections. Made to take 1/16" square or round bus-bar wire. Can be attached with a pair of pliers.
M2975 "T" Wire Connectors, 12 for....$0.05



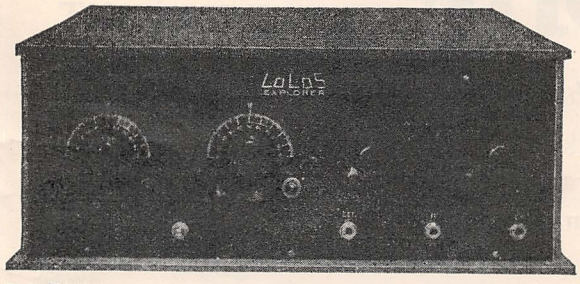
Nickel Screws

Made of brass, nickel plated. Flat and round head style. Any thread up to 10/32".
Price, ¼", ⅜", ½" long, dozen .....$.15
Price, sizes ¾" and 1" long, dozen .....$.30

Duo-Spider Coil

For Reinartz circuit, 200-600 meters. 19 taps. Size 4¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
M2650 Spider Coil $1.15
M2660 Coil for panel mounting. 225-600 meters $1.90

THE "LOLOS EXPLORER"



HERE is a 3-tube set that is positively a "knock-out." It is of the latest low loss type throughout. It contains a low loss 3-circuit tuner, a low loss Condenser, low loss Sockets, etc., and will bring in stations a thousand miles away on the loud speaker. See list of stations logged inside of two hours. **This is not a newfangled new set,** no latest revolution, no "wonderdyne," no extravagant freak circuit. Instead, it is a good, old-fashioned 3-circuit set, **but it reduces all the previous known losses to practically zero.**

Its great secret lies in the fact that practically all losses are done away with and that the greater part of energy heretofore wasted in similar sets **is conserved**—hence the astonishing results possible with this set.

By means of the low loss 3-circuit Tuner and the low loss Condenser the set has razor sharp selectivity; that is why we furnish verniers, and even these must be handled carefully as distant stations can be brought in or lost by a 1/64-inch motion of one of the dials.

The great outstanding merit about this set is that it will cut right through locals and bring in distant stations. Moreover, as the chart shows, **you can log stations** and as there are only two dials you can always tune in stations at exactly the same settings, once you have brought them in.

At the price advertised, the set comes to you with all parts, even the screws, complete to assemble, which can be done within two hours. There is nothing missing—mahogany cabinet, a drilled panel, and baseboard are all included. All you have to get is three tubes, and "A" and "B" Batteries, which are not included in the price. We have never tested an outfit more suitable for long distance broadcast reception, and we guarantee the **"LoLos Explorer"** in every respect. Your money refunded if this set is not entirely satisfactory to you in all respects. Works equally well on 201A or dry battery tubes.

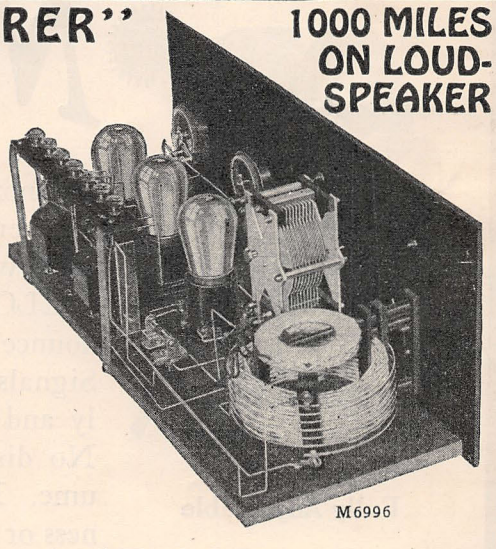
IMPORTANT—No technical knowledge required to build this set. Directions are so explicit, so simple, so clear that a 12 year old boy can readily put our set together.

STATIONS LOGGED ON "LOLOS EXPLORER" in 2 hours at New York City

Station	Dial Settings		Location
WJZ	72	65	N. Y. City
WEAF	86	77	N. Y. City
WFBH	65	21	N. Y. City
WFAM	55	18	St. Cloud, Minn.
WQAO	73	40	N. Y. City
WEBH	75	43	Chicago, Ill.
WJY	72	52	N. Y. City
KDKA	70	32	Pittsburgh, Pa.
WTAS	67	25	Elgin, Ill.
WGBS	67	30	N. Y. City
WHN	72	39	N. Y. City
WJAX	88	48	Cleveland, Ohio
WIT	75	83	Philadelphia, Pa.
KYW	78	93	Chicago, Ill.
WOC	83	74	Davenport, Iowa

ALL ON LOUD SPEAKER

1000 MILES ON LOUD-SPEAKER



M6996

List of Parts

1 "Gen-Win" Low Loss Coupler; 1 7x18 Mahogany Cabinet; 1 7x18 Panel already drilled; 1 Baseboard; 2 "Calibrated Somerset" Audio Frequency Transformers; 1 "Certified" Low Loss Condenser; 2 Rheostats; 3 Bakelite Sockets; 2—3" Dials; 3 Jacks; 7 Binding Posts; 1 Grid Leak and Mounting; 1 .00025 Condenser; 2 Dial Markers; 2 RASCO Verniers; 2 Angle Plates; 10 ft. Bus Bar; 1 Switch; 1 Bakelite Binding Post Strip; 7 Binding Post Name Plates; 24 Screws; 1 Set of Directions. Total Price of Goods $33.71

OUR PRICE **30.25**

New 1925 "Rasco" Catalog No. 12

CONTAINS 75 VACUUM TUBE HOOK-UPS, 300 ILLUSTRATIONS, 500 ARTICLES, NOW 100 PAGES

All Armstrong Circuits: These important circuits are explained clearly, all values having been given, leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits: The V.T. as a detector and one-step amplifier; all Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; all Reflex Circuits.

FREE

A POSTAL CARD BRINGS IT

Wanted

This Company is always in the market for new ideas. Any small specialties in demand by the radio fan will be highly welcomed by us. Some of the articles shown on these pages originated with our customers, whom we paid well for the ideas. Send your sketch or model addressed to Research Department, c/o this Company.

M6060

SPECIAL

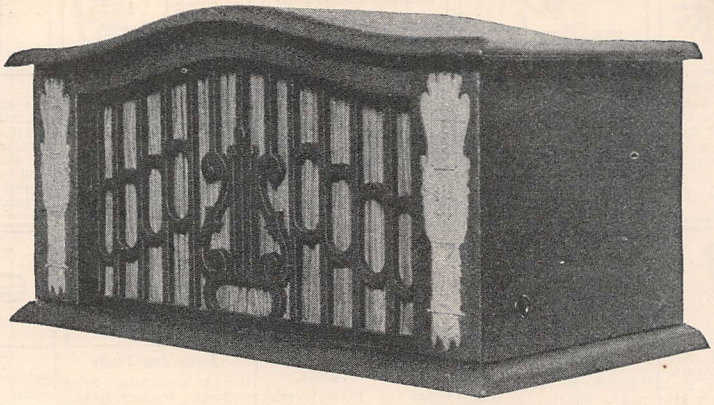
Genuine RICO 2000 ohm double head set. Standard phone with 6-foot cord. Tripole type. Regular price, $4.00. Our special price. **M6060.**

$2.50

Money back if not satisfactory.

RADIO SPECIALTY COMPANY, 98 PARK PLACE, NEW YORK CITY

MELOTONE Cabinet SPEAKER



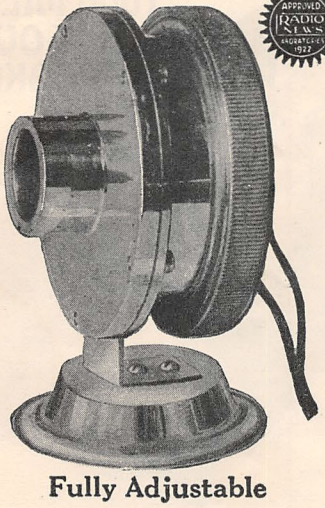
Aristocrat Model

$35.00

Fully Adjustable

Within the hush of luxurious drawing rooms, on that correct console near the grand piano graced by the carelessly flung Belgian tapestry, you will find the MELOTONE, a flattering reflection of one's good taste in art, and sound technical judgment in radio loud speakers.

For MELOTONE, America's most exquisite cabinet speaker, is not alone the perfection of an artistic creation, but a sound product of a three-year test by our research engineering department. MELOTONE brings to you the truest replica of speech and sound. Each delicate shading of the human voice, every note and enchanting shade of music, comes to you through MELOTONE'S throat with the fidelity of an echo, the truth of America's finest, most perfect loud speaker.



Fully Adjustable

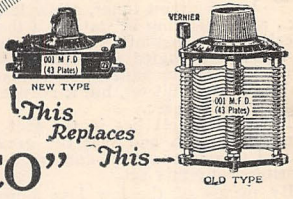
MelotonE PHONOGRAPH ATTACHMENT

Fully Adjustable. Finest on Earth

$7.50

It is now really possible to make a perfect loud speaker out of your phonograph. The engineers who spent six months in developing the MELOTONE Phonograph Attachment announce it as complete under every test. Signals are reproduced clearly, sweetly and with a stirring resonance. No distortion. Excellent volume. Not a trace of hoarseness or rattling.

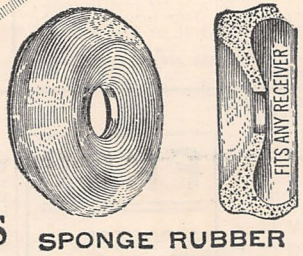
This MELOTONE Unit insures the perfect tone. It is the famous unit which has brought the MELOTONE ARISTOCRAT CABINET SPEAKER world wide praise. Attach a MELOTONE to your talking machine today—then listen!



This Replaces This—

"RICO" STRAIGHT LINE CONDENSER

A condenser makes a lot of difference in your set. Why not use the best? RICO requires two-thirds less space than the mesh type, is marvelously low loss and is DUST-PROOF. Adaptable for any circuit .00025, .0005 or .001 mfd. Complete with dial $1.75. Without dial $1.50.



"RICO" FONEKUSHIONS

SPONGE RUBBER

Made of soft, velvety sponge rubber, thye fit any phones and make listening in on a headset a genuine delight. Be sure to get the original—look for the name "RICO."

50c

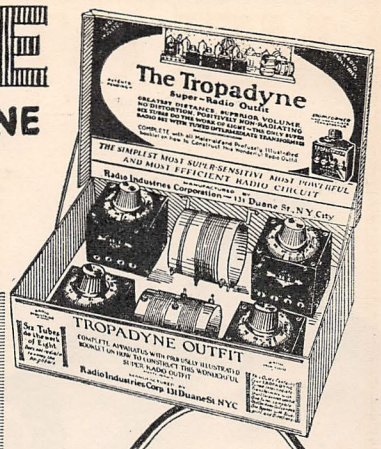
RADIO

133 DUANE

NEW YORK

$28.75 TROPADYNE

SUPERIOR TO SUPER-HETERODYNE



The experts were astounded. But they had to admit that the TROPADYNE CIRCUIT does the work of 8 tubes with SIX! It sweeps the country at your will and brings in all stations on an indoor loop.

Imagine the money-saving to you when 6 tubes do everything the 8-tube set tries. Cheaper to build at the start, costs less to maintain and always easier to operate. TROPADYNE with a giant power and the sensitivity of a scientific instrument is truly a wonderful value.

The complete TROPADYNE KIT contains the necessary parts with complete set of instructions and illustrations. It costs only $28.75. See it today at your dealer's.

TROPAFORMERS

The TROPAFORMER is the heart of the famous TROPADYNE circuit.

TROPAFORMERS are the best long wave transformers because they can be TUNED.

A RICO straight line condenser is built into every TROPAFORMER. It is this feature which makes individual tuning possible.

When TROPAFORMERS are first installed they are TUNED to be matched. They need not be touched again thereafter, as the balance is permanent. The improvement in results will surprise you. Distances you have never been able to get will come in easily.

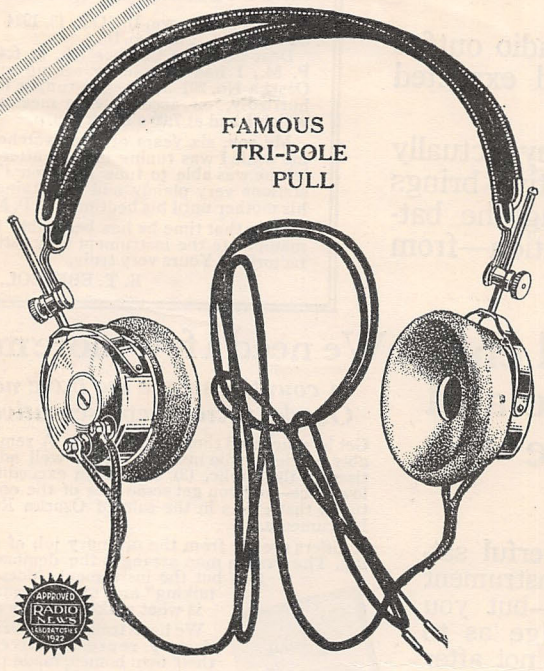
Your dealer also sells TROPAFORMERS separately.

$6.75

$2.95

RICOFONES

Finest Phones Made



Even if you had the best set in the world, the quality of your reception is up to your phones. Hence RICOFONES. If you haven't the best set in the world, RICOFONES can do even more for you. Their clear musical tone have helped establish radio as a fine source of entertainment. Results are better with Rico Phones. After all, your set deserves a pair. And the price is $2.95. Is there any reason for paying more?

RICOFONES are quaranteed exactly matched in tone, every pair is fully tested. The famous RICO patented features are contained. Expert supervision, quantity production, and selected materials has made RICOFONES the outstanding radio value. Built robustly, they stand up and carry their mellow sweet tone truthfully.

RICOFONES ARE GUARANTEED ABSOLUTELY FOR ONE YEAR

We are absolutely the largest manufacturers of tri-pole pull phones in the world.

If your Dealer cannot supply any of these products, order from us—using coupon.

RN3

INDUSTRIES CORP.

STREET

CITY

Radio Industries Corp.,
133 Duane Street, N. Y. City.

Gentlemen:

As my dealer cannot supply me, kindly ship me the following material for which I will pay postman on delivery.

.....

Name .....

Address..... City..... State.....

Here's the right way to investigate a radio instrument

This button identifies Ozarka representative in your city—is your assurance of complete radio satisfaction.

It's one thing to hear a radio instrument give an impressive performance in a dealer's store or someone else's home, but entirely different to get thoroughly satisfactory results in your own home with your own operation.

Thousands of folks have spent their good money for radio outfits that are not delivering the results they had hoped and expected to receive.

Ozarka Radio Instruments are sold on the results they actually show you in your own home. The Ozarka representative brings the instrument to your home and sets it up, supplying the batteries, the aerial, and all equipment for the demonstration—from that point on the instrument is yours for the evening.

6-Year Old Children readily "tune" OZARKA

Here's what one youngster did:

Ottawa, Ill., Oct. 13, 1924

Ozarka, Inc., Chicago, Ill.

Dear Sirs—On October 7th, at 6:45 P. M., I had completely set up my Ozarka No. 201 and began tuning in, hurriedly, on account of a meeting which I had at 7:00 o'clock sharp.

My son, six years of age, watched me while I was tuning in, and after I left he was able to tune in seven (7) stations very plainly and entertained his mother until his bedtime at 8 P. M.

Since that time he has been able to manipulate the instrument very satisfactorily. Yours very truly,

E. T. EBERSOL.

Tune in yourself — let the wife and children tune in. Test for Tone, Volume and Distance and then—decide if it gives the radio results You want

If you invest in an Ozarka Instrument, our representative installs the equipment and leaves it in perfect, working order, and is always near at hand if some little problem comes up that you can't figure out for yourself.

Through the Ozarka Plan of demonstration in the home, people are finding that Ozarka gives the radio results they want—at far less expense than they thought possible.

We predict you will be greatly pleased with the easy-tuning Ozarka—it gives wonderful satisfaction as a radio instrument for the whole family—but you will be the sole judge as to whether you want it or not after you hear it, after you swing the dial yourself and know exactly what Ozarka will do in your own home.

Let us know you are interested in hearing Ozarka in your home, and we will make the arrangements. Send for large illustrated book No. 200 and don't fail to mention your county when you write.

We need a few more men

in counties where we have no Ozarka factory representative

Get in your mind these details: (1) A remarkably efficient radio instrument, (2) well advertised to the public, (3) sold at an exceedingly low price—and you get some idea of the opportunity that exists in the sale of Ozarka Radio Instruments.

It differs greatly from the ordinary job of selling. The Ozarka man arranges the demonstration but the instrument "does the talking" and its performance is what makes an easy sale.

We have trained 3100 Ozarka factory representatives in their own homes, made them thoroughly capable, in a short time, of assembling Ozarka instruments, installing the complete equipment, and qualified to wear the Ozarka button.

The right man soon becomes the sole Ozarka representative in his territory and makes an excellent income, because so large a percentage of his demonstrations lead to sales. A small investment is necessary. Experience in selling is valuable but a willingness to learn is necessary. A clean record and a good reputation locally are essential.

If you're interested in the possibilities as outlined, write and tell us about yourself, who you have worked under during the past five years, and be sure to give the name of your county. We will send our Ozarka Plan Book No. 100. It may prove to be the most important thing you ever read in your life.

OZARKA INC., 804 Washington Boulevard Chicago

RADIO NEWS
H. GERNSBACK, Editor and Publisher
ROBERT E. LACAULT, Associate Editor
EDITORIAL AND GENERAL OFFICES, 53 PARK PLACE, NEW YORK
Vol. 6 MARCH, 1925 No. 9

Radio, the Phonograph and the Theatre

By HUGO GERNSBACK

TO THE student of history, the evolution of utilities is well understood and, as a rule, can be charted in advance.

When our only means of transportation was the horse-drawn vehicle, the railroads suddenly appeared. Immediately cries went up that the horse-drawn vehicle was doomed to meet its death. But, decidedly to the contrary, there are more horse-drawn vehicles in use today than there were when no railroads existed. In other words, the railroad has supplemented the older form of transportation and created new uses and new business for it which were not dreamt of before the advent of the steam car.

Not so many years ago, when the telegraph first appeared, it did a great business. Then the telephone came along and at once the cry went up, as usual, that in a few years the telegraph would be obliterated. As people could talk together, they certainly would not waste the necessary time to telegraph and send long messages, when the spoken word was so much cheaper. The prophets, however, were wrong, as usual, and the telegraph business today, despite the telephone, is thousands of times larger and does more business than it did before the advent of the telephone. It is just another case of one utility aiding and enlarging another.

When the bicycle first was invented, everyone hailed it, until the automobile came along. And then again the cry went up that, surely the bicycle—"which is nothing but a fad, anyway"—was doomed. As the people could ride in automobiles they certainly would not ride on bicycles. Again the prophets were wrong. As any statistician can tell you, there are today actually many times more bicycles in use than there were before the automobile. But why go on with a long list? It becomes monotonous in its sameness.

This introduction is given simply because, in 1922, the usual cry went up that people with radio sets in their homes would have no more use for the phonograph, and that the latter would soon disappear from the face of the earth.

Great was the shout that went up, three years ago when broadcasting first appeared, from all phonograph manufacturers and dealers, and their gloom was matched only by their short-sightedness. Many articles appeared in the leading journals, particularly those devoted to the phonograph interests, depicting dark and dismal views upon the future.

It is interesting to note that available statistics now show that there are more phonographs used at present than before the advent of radio, and that more records are being sold than at any time during the history of the phonograph.

IN THE June, 1922, issue of RADIO NEWS, the writer made the following predictions, which are interesting now, chiefly because of their fulfillment. In that issue, the writer said as follows:

"It costs money to buy phonograph records once you have the machine. It costs nothing to have all the music in the world which you desire, once you have a radio outfit. But there is no reason in the world why the two should not get along harmoniously, even as conditions are at present.

"You will no doubt find, during the next two years, that every phonograph store will be selling radio appliances. In many cities throughout the east they are already following such a plan, having been driven to it by a slump in business. The leading phonograph trade journal now has a radio section. The logical upshot of it all will be met when the phonograph interests, instead of opposing radio, open their arms and welcome it.

"This is precisely what we are coming to. The machines of the future will serve the double purpose of record-music and radio. Thus the public will be given a new incentive to buy phonographs, which incentive seems to be lacking at the present time. The more the two can be cemented together, the better the results, not only for radio—which does not need any assistance—but certainly for the phonograph."

The preceding paragraph is interesting, because this very prediction has come true. The largest phonograph manufacturer in the country is actually making a phonograph now that has space for a radio outfit, while another very large phonograph manufacturer is equipping his product with a set made by one of the largest radio manufacturers in the country.

We may, therefore, say that the writer's prediction that the radio and phonograph industry would be welded together has become an accomplished fact.

A few weeks ago, on New Year's Day, there arrived the big event for which the entire radio industry had been waiting, namely, the advent of grand opera stars into the field of radio entertainment. John McCormack, famous concert singer, and Lucrezia Bori of the Metropolitan Opera Company, through the courtesy of the Victor Talking Machine Company, broadcast to an audience that is variously estimated as being composed of from six to eight million listeners. It is also estimated that the broadcasting of these two artists sold no less than 150,000 phonograph records of the selections they sang before the microphone. We do not believe that manufacturers of phonograph records, in their wildest dreams, before the advent of radio, ever imagined that they could sell as many records during one single occasion as they did on this one. And so it goes.

THE latest ravings are from the theatre. The theatre has as yet not learned its lesson from the phonograph manufacturers, and when, during the broadcasting of the stars just mentioned, on January 1st of this year, half of the theatres in New York were empty, the theatrical magnates at once had a bad case of nerves, because they claimed that their theatres stood empty while people stayed at home and enjoyed the free radio concerts.

So far, the theatrical interests have always worked against anything connected with radio. Some of them go so far as to forbid their actors appearing before the microphone. Others, if allowed to broadcast a play, find it necessary to pay their actors double salaries if such a play is broadcast. It is about time that the theatrical interests learned that they cannot fight radio with such prehistoric weapons. The thing to do is to work *with* the radio interests, as the phonograph interests have found it profitable to do.

The writer has not changed his mind since 1922. In June of that year, in RADIO NEWS, page 1146, he broached the subject and said as follows:

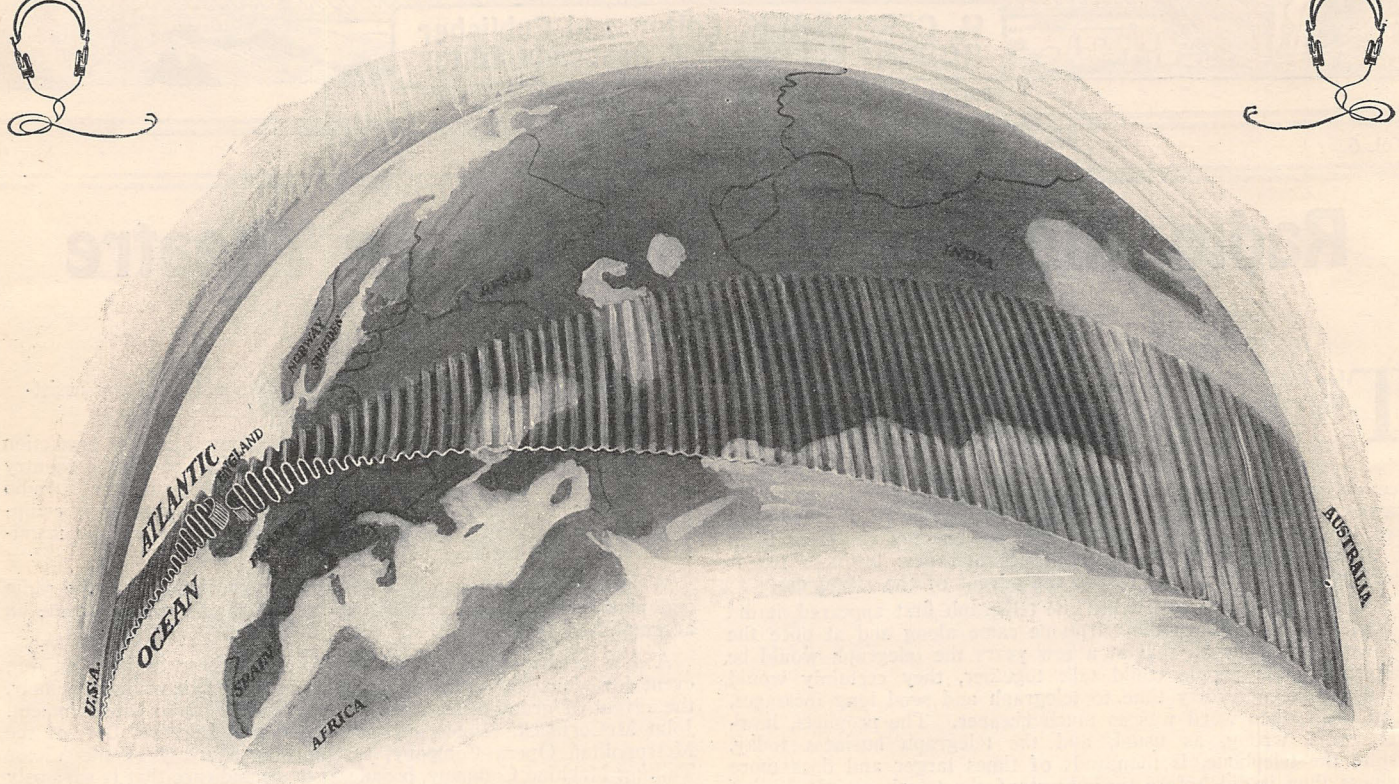
"Of course, any one who thinks about the matter calmly must appreciate the fact that, if anything, radio certainly gives the theatre, the actors and the singers the best possible advertising medium. One surpassing their best imagination. Think of an audience of 300,000 people listening to a singer! What better advertising could there be? And some of these 300,000 people, when they get to town, as they invariably do, will wish to see and hear that singer in person. The radio audience is not always a radio audience; it frequently becomes a theatre audience as well. To think that a radio man is shut in all the year around is ludicrous.

"Even the most ardent radio fan, after listening in for five or six days in the week, will wish to go to a show on the seventh day. One of these days the theatrical interests will wake up to the fact that in radio they have the greatest possible and the very cheapest advertising medium ever available to them."

What was true in 1922 is even truer in 1925.

Marconi's Radio Beam Transmitter

By LIEUT.-COL. CHETWODE CRAWLEY, M.I.E.F.



Showing how the radio waves travel out from a beam transmitter. All the energy is concentrated into a beam instead of being dissipated in all directions, and consequently the signals carry further. The shaded area shows the surface covered by the waves.

SINCE the first announcement a few years ago of the beam transmission of radio, the savants of the art have consistently predicted that the future would find this form of communication becoming constantly more important.

The first step in this direction is the letting of contracts by the English government for the erection of several beam stations through which they hope to keep in constant touch with the Colonies. One circuit will connect with Canada, another with Australia, and a third with South Africa. One of the most important points in the contract is the stipulation that the spread of the transmitted power shall be confined within 30 degrees of arc. The use of the stations will be confined almost wholly to state purposes.

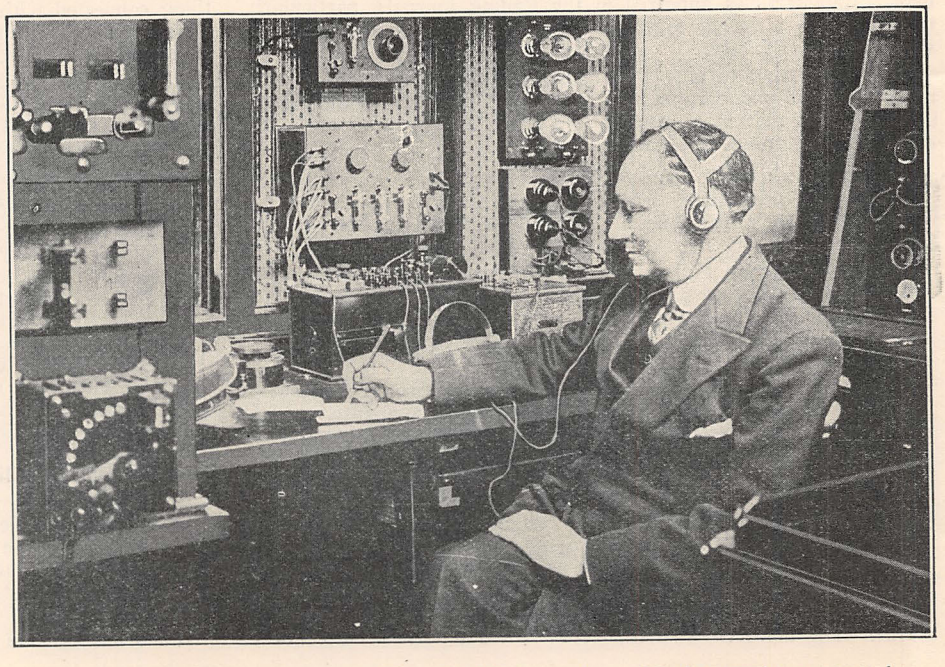
It is a long step from the old Marconi 10-inch spark coil and the first "s" to cross the Atlantic to the present-day long-wave high powered stations. And it is almost as long a step from the high powered stations using their hundreds of horse-power to the present-day short-wave beam stations using only a fraction of the power and working greater distances.

THE FIRST LONG-RANGE WORK

The first long-range radio telegraph service was that established by Marconi in 1902 between stations in England and Newfoundland, which were installed with quite small power, in fact, about the same power as that proposed for the new "beam" stations for the English government. But this trans-Atlantic working 22 years ago could not by any legitimate stretch of imagination be called reliable. It was very slow and only possible at all under good atmospheric conditions. In fact, it was distinctly unreliable, but it was the brilliant opening of a completely new system of world communication. From that date the technique of long-range working has progressed steadily, if not quite so rapidly as was at first anticipated. At first, indeed, the very wonder of the achievement threw a glamour over its future, especially when described by those whose warm imaginations were untrammelled by the colder facts of technical knowledge.

Until now, nearly all improvements at the transmitting stations have involved the use of more and more electrical power; in fact, the 30 horse-power first used for trans-Atlantic communication has now been increased tenfold, and this although the sensitivity of the receiving instruments has been enormously improved. At the present moment the English government is erecting at Rugby one of the most powerful radio stations in the world.

This steady increase of power has produced a very marked improvement in the efficiency of communication, so that now trans-Atlantic working is reasonably reliable and the speed of signaling has been increased about tenfold, which makes the service comparable with that given by cables. However, there are only two stations in England capable of providing a satisfactory long-range service—the Post Office station near Oxford and the Marconi Company's station at Carnarvon. The Oxford station carries



Senatore G. Marconi on his yacht "Electra" which he employs solely for carrying out tests in radio. The "Electra" is completely equipped with experimental appartaus.

out services with Canada, Egypt, and with ships; and the Carnarvon station works with America.

FACILITIES IN OTHER COUNTRIES

This state of affairs compares most unfavorably with the facilities for long range radio communication in the United States and in France. The United States has 13 large stations, and France has five, apart from stations in their possessions overseas. Five of the United States stations are worked by private enterprise and conduct services with England, France, Germany, Norway and Japan, the eight other stations being worked by the government for state purposes. Two of the French stations are worked by private enterprise and conduct services with the United States, Argentine and Syria, the three others being worked by the government for state purposes and commercial services to French possessions abroad.

In Italy there are two large stations which communicate with her Colonies and with the United States, and in Germany there are three, which are used principally for communication with the United States.

Such, then, is the position at the moment as regards facilities for long range radio communication with the principal countries in the world.

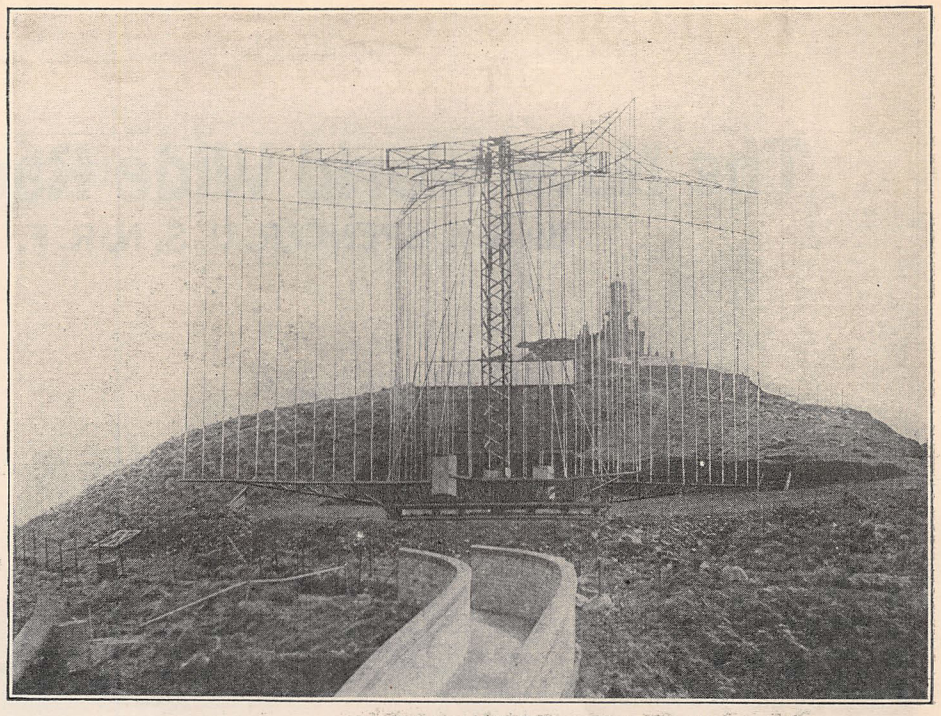
THE BEAM SYSTEM

At this juncture Mr. Marconi made known the results which he had recently obtained with the beam system, and in July, 1924, the government entered into an agreement with the Marconi Company for the erection of a beam station for communication with a corresponding station in Canada, with provision for its extension so as to provide similar communication with corresponding stations in South Africa, India and Australia.

The beam system is an arrangement for transmitting radio signals on short wavelengths in the form of a beam, somewhat similar to the searchlight's beam of light waves.

THE USE OF SHORT WAVES

The lengths of the waves used by Marconi for signaling over long ranges were about 100 meters, whereas those used by the latest long-range stations are as great as 20,000 meters, and the power used by Marconi was about 20 kilowatts compared with 500 to 1,000 kilowatts used by some of the present large stations.

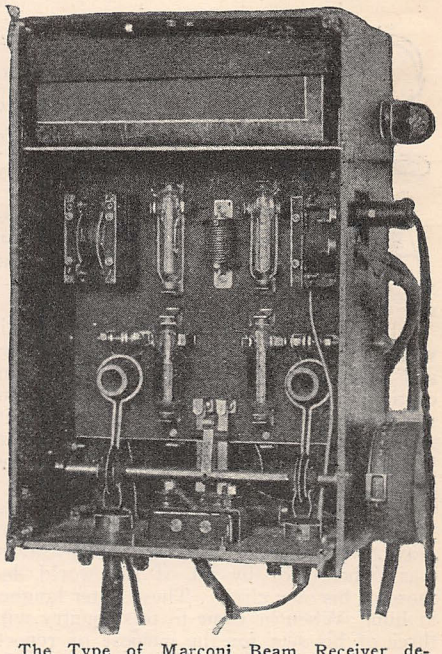


The Marconi parabolic rotating beam transmitter at Inchkeith Island. Signals can be transmitted in any direction desired.

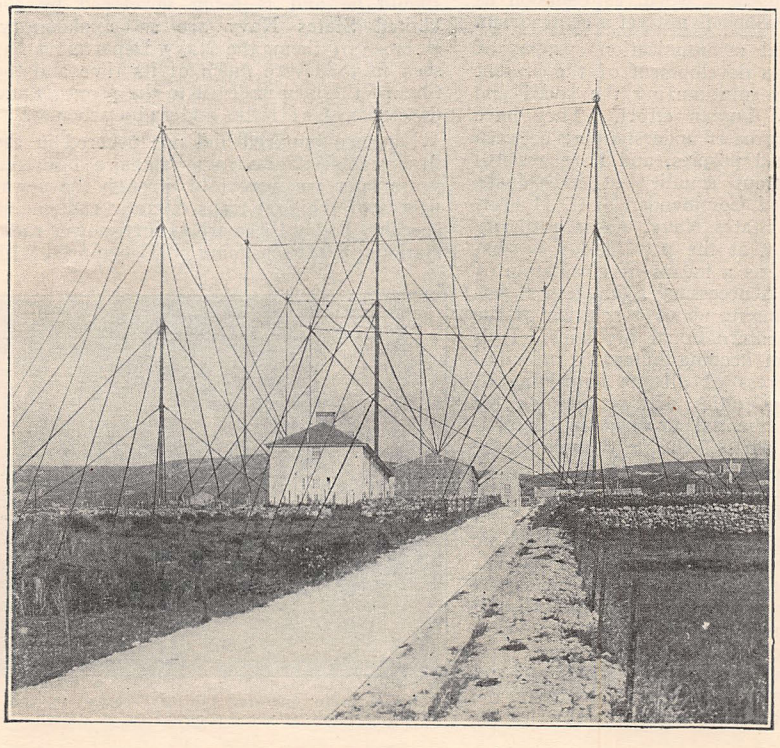
Short radio waves were used by Hertz in his classical experiments at the birth of radio, nearly 40 years ago, and about 10 years later were used as a beam by Marconi at his first demonstrations in this country, after which the rapid and spectacular progress made with long wave working, completely overshadowed those early results, and diverted research into channels which have given us the long wave high-power station of today. Nothing further was done with short wave beams until 1916, when Marconi again returned to his long abandoned investigations, in connection with certain war requirements.

CONCENTRATING THE BEAM

In his present beam system the reflector used at the transmitting and receiving stations consists of a number of wires placed parallel to the aerial and spaced around it on a parabolic curve of which the aerial forms the focal line. The power input will be at least 20 kilowatts, and the emitted wave concentrated within 30 degrees. The station for communication with Canada will be able to communicate each way at a speed of 100 words a minute, exclusive of repeti-



The Type of Marconi Beam Receiver designed especially for use on shipboard.



The high powered Marconi Company station at Carnarvon which handles traffic with the United States.

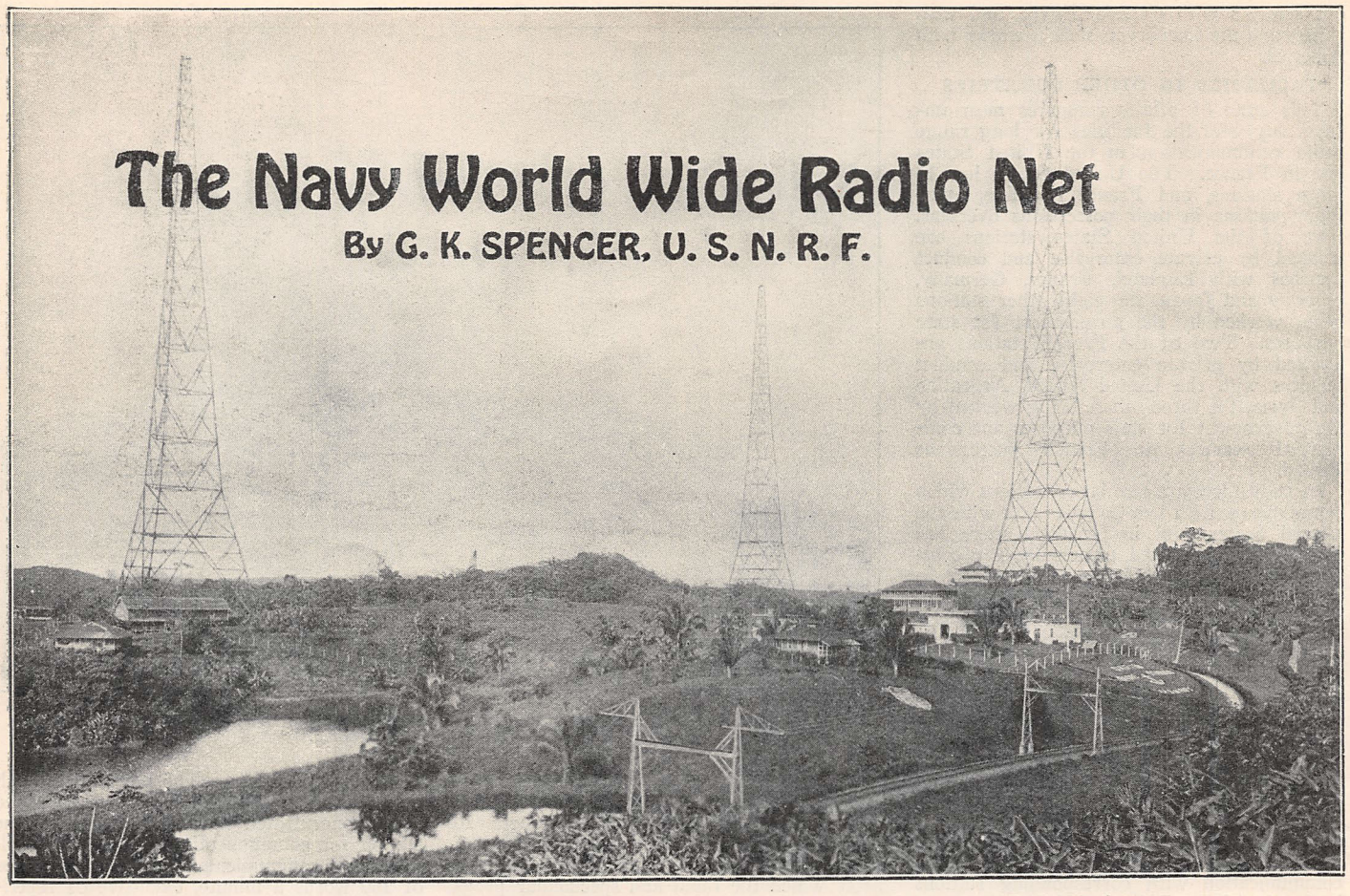
tions, during a daily average of 18 hours. Additional units are to be similarly guaranteed, except that the periods of working with South Africa, India and Australia are to be respectively 11, 12 and 7 hours daily.

The speed of working contemplated is thus much greater than would be expected from high-power stations, as high speed signaling is facilitated by the use of low power and short waves, but the daily average periods of working are smaller than would be expected from high power stations, as the intensity of signals on these short waves varies inversely in proportion to the mean altitude of the sun when above the horizon;

(*Continued on page* 1777)

The Navy World Wide Radio Net

By G. K. SPENCER, U. S. N. R. F.



Temporary Navy radio station at Balboa, Canal Zone. This was built during the war and is now being used by the Navy Department to relay messages to Naval ships going through the Panama Canal.

A review of the progress of radio in the U. S. Navy. At present there are forty-four high-power Naval stations which constitute a complete communicating circuit that spans the globe. Many of the stations are employed for handling commercial traffic as well as the official communications.

A UNIVERSE of talking planets—oozing wave-lengths flashing from solar system to solar system! Industry in the air—air commerce—war in the air!

All these will come—and more. Radio will bring them. In radio there is a nucleus, and radio is yet in its infancy. Our conception of radio is yet hazy and will continue to be for many years to come; its metamorphosis since Marconi started tinkering with his little machines in 1899 proves that.

The first serious investigation, be it noted, was made in that year by the United States Navy. Until that time the Italian savant was unheard of by all of the world, but those of his own circle. These latter laughed at him. When he came to this country with three of his sets for the purpose of reporting the International yacht races between the *Columbia* and the *Shamrock*, the Navy Department detailed four officers to observe and report upon the workings of these instruments. The reports were so promising that two ships and a torpedo boat were placed at the disposal of Mr. Marconi. From that time on the science rapidly progressed until today we have: radio telegraph, radio telephone, radio compass, radio sonic depth finders, sound telegraphs and even radio pictures. A radio epoch, indeed!

A REVIEW

To the lay mind the radio has been and will be no more than it is, a means of communication. To the great minds now experimenting, radio is a force which will rule the air, the land and the sea within 25 years. Already the giant vessels of the air are successfully operating on long flights by means of radio; submarines have been doing that since the World War; what radio is to the land and its inhabitants is obvoius, and its name is a household word, as common as the telephone, which is not yet a centenarian.

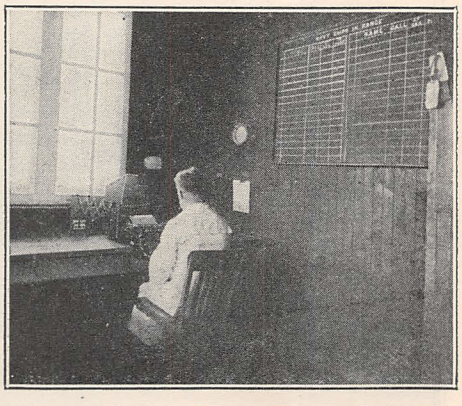
The electrical communication systems of the world are a development of the present half-century, revolutionizing the speed and convenience of human effort. They have brought about greater understanding between widely separated peoples, and have assisted in bringing about equality of individuals. In the words of Commander S. C. Hooper, of the United States Navy, whose authority on radio cannot at the present day be disputed: "Radio, as a means of circulation of intelligence, is a necessary adjunct to statesmanship in bringing about a solution of the world's great international problems. It is indispensable in keeping humanity informed through the press of all the happening of all the nations, cities and peoples of the world. It is essential to business competition, and is a part of the very home in the provision of comforts and facilities necessary in this age and generation. It is vital for military efficiency."

It is well here to note of what intrinsic value rapid electrical communication may be:

Increases national military security; assists in education from scientific attainments; adds to personal convenience and happiness; necessary in connection with business and transportation; aids navigation, safety at sea and safety in operating railways; improves the common understanding and thereby lessens wars; increases business ability through keeping the world informed of events and conditions of business securities; vital to the national unity and efficiency.

These eight foregoing reasons why radio should be and is being developed by the United States Navy are self-explanatory. Because of them, the Navy Department has seen fit to devote much of its time and the time of the men under it to the progress and development of radio and radio schemes.

Nineteen hundred and one ushered in the first trans-Atlantic radio signal. Fourteen years later we were told through the newspapers of the first trans-Atlantic radiophone speech. Today there are 44 high-power radio stations; 8,000 sea-going ships equipped with



Naval radio operator taking "relays" in the wire room at the Arlington radio station.

radio; between 700 and 800 medium and low-power shore radio stations; and roughly 20,000 amateur transmitting stations in the world, and nine-tenths of all these are in the United States.

Up to the beginning of the World War, the principal application of radio was for exchange of traffic between ships and the shore. During the war the applications of radio for aiding navigation, trans-oceanic communication and for aircraft were developed to a considerable degree, and since 1920 the radio telephone broadcast has been added. The broadcasting of pictures has been completed, experiments on sending radio-moving-pictures are being made. There are countless other radio achievements left yet to complete the art.

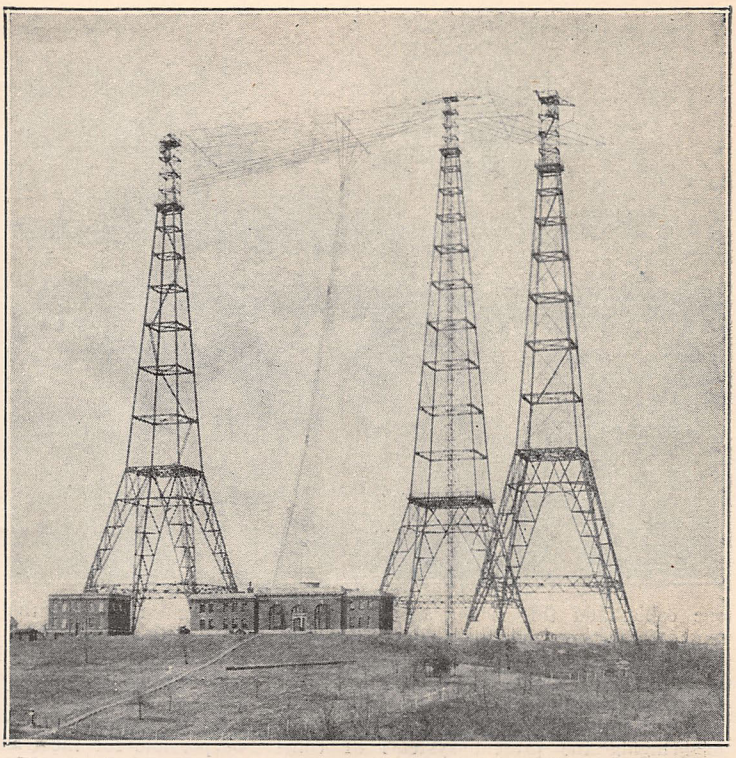
CABLES SUPERSEDED

The trans-oceanic traffic of radio and what it is doing to the cable system is astonishing. The trans-oceanic traffic of the world amounts roughly to one-half billion words per year. The total trans-ocean cable mileage is about 300,000; the trans-ocean radio circuit mileage, 135,000 miles or two-fifths of the cable mileage.

Cables operate both ways at the same time, each cable handling about 50,000 words per day, or 25,000 words per day in each direction. At the present writing it is the information that the cables are busy at about 60 per cent. of their capacity.

The best equipped radio circuit, officials of the Navy have discovered during recent surveys, can carry about twice the traffic of the best equipped cable circuit under good atmospheric conditions, and an equal amount under average conditions. This proves the superiority of radio over cable systems.

The Navy operates high-powered government traffic and press between Washington and the strategic possessions of the United States, including the Philippines, Hawaii, Alaska, Porto Rico, Guam, Tutuila and the Canal Zone, relaying through west coast stations en route to the Orient. Including trans-oceanic traffic stations, aircraft and navigational aid stations and ship stations, the United States Navy has the most comprehensive radio system in the world.



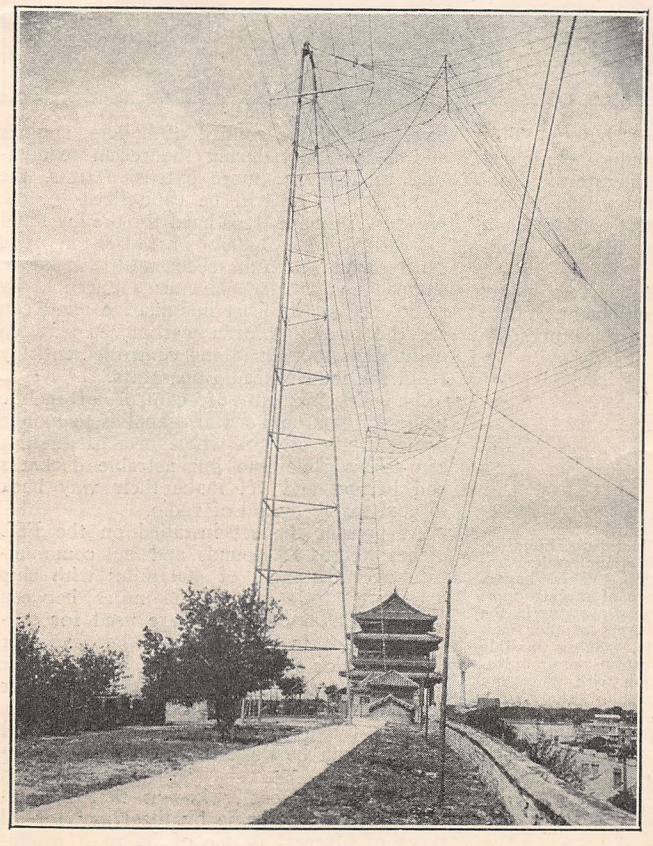
The great radio station at Arlington, near Washington, D. C. This station is one of the greatest achievements of the Navy. It is employed mainly for connecting the Navy Department with our Atlantic Fleet, and relaying messages to other Naval radio stations.

There are in all 95 radio compass stations throughout the world, of which 55 are under control of the Navy of this country. These stations are provided to assist the mariner in closing the land during fog or poor visibility. They are also used extensively by the Navy to obtain the positions of vessels, enemy or friendly, at sea. In times of peace as in times of war, these stations have been found to be of matchless value.

Complex and complicated as the Navy's radio system may seem to the layman, it is by far the best system of communication that the Navy has. Its high-power circuits for communication with outlying possesions includes: Washington, using distant control transmitters in Arlington, Annapolis and Sayville, to Porto Rico, Washington to Canal Zone; Washington to Europe; Washington to Mare Island and San Diego; Mare Island to Pearl Harbor, Hawaii; Pearl Harbor to Manila; Manila to Peking; Pearl Harbor to Guam; Pearl Harbor to Samoa, and Puget Sound Navy Yard to Cordova and St. Paul, Alaska.

The Navy maintains medium power stations at Boston, Norfolk, Charleston, Key West, New Orleans, Great Lakes, San Diego, San Francisco and Puget Sound, for relaying messages between low-power stations and ships, and for exchanging messages with ships at great distances. The longest distance over which direct connection is made is between Manila and San Francisco, over 6,000 miles, in which nearly all the eastbound traffic is handled without delay.

Several of the high-power Naval stations broadcast press bulletins each evening for an hour, for the benefit of ships at sea. In every ocean a ship may copy nightly the American press. The stations transmitting press are: San Diego, Arlington, Key West, Canal Zone.



China has seen great development since the discovery of radio. Here is pictured a modern radio tower located in Pekin, China.

CHIEF FUNCTION

The main function of the radio departments of the Navy is to handle communications. In times of war this is a work that has to be done rapidly and efficiently; quick communication between the Navy Department, our fleets and our outlying possessions was one of the most important things during the world conflict, and will be far more important in the next war—if there is a war.

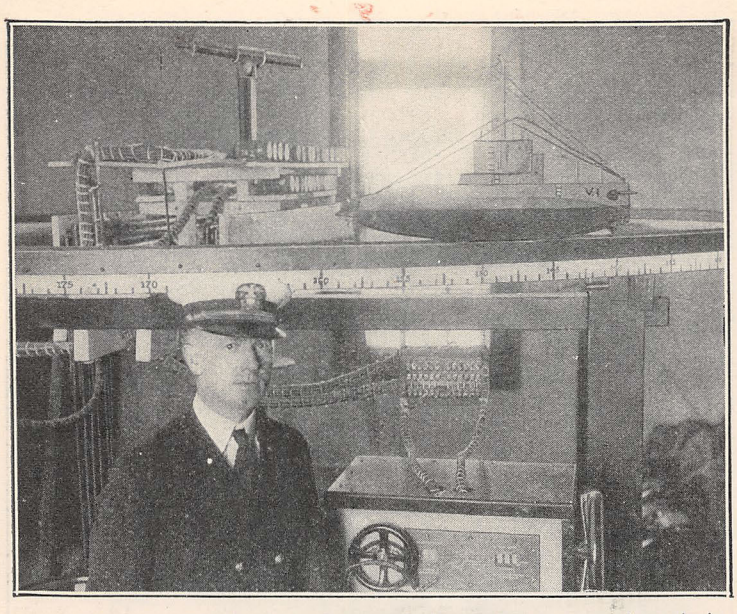
Our communications in the Atlantic—speaking from the standpoint of the Navy Department—are carried on chiefly by radio. Radio in this sense is becoming a very formidable competitor of the thirteen cables connecting the United States with Europe. The Navy's main radio stations in the Atlantic are: Bar Harbor, Sayville, L. I.; Annapolis, Arlington, Gayey, P. R.; Guantanamo, C. Z.; and Panama.

Bar Harbor receives all official messages from Europe, from the fleet in the West Indies and from the Pacific. Sayville is a transmitting station for the fleet and a stand-by for Annapolis. Annapolis is our chief transmitting station to Europe and the Pacific, both Annapolis and Sayville being controlled from Washington, the actual operating of these stations being done in the Navy Department. The Sayville station was taken over during the World War and is now used principally for communicating with the ships of our fleet when they are in the West Indies.

ADDED SERVICE

All of the stations in the Panama Canal Zone are under the jurisdiction of the United States Navy, although there have been many changes made to gratify the desires of the inhabitants of the Zone, and the Navy Department has authorized our stations in the Zone to broadcast entertainment programs.

In the Pacific the plight of the systems of communication is drastic. Only one cable connects the United States with the Far East, that of the Pacific Commercial Company. Due to the fact that there is only



The Navy's submarine sound apparatus. Note the model submarine (V-1) which is used to test apparatus. It runs on a circular track around the detecting instruments, while radio sound students chart its movements.

one cable, and this is out of commission most of the time, especially during the winter months, when it is most needed, radio has been little less than a God-send to the Far East and the islands of the Pacific.

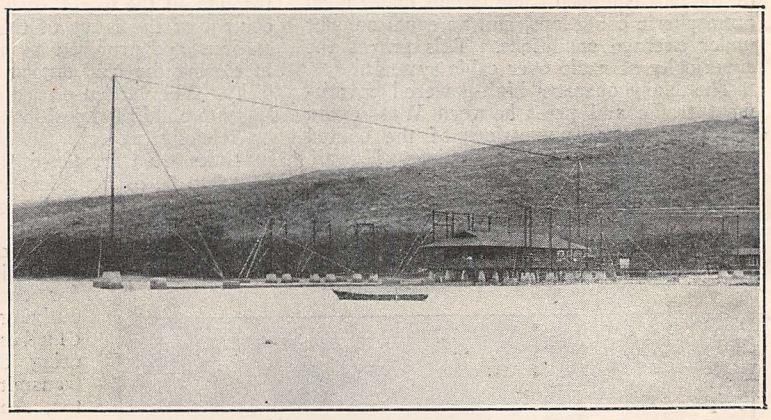
The American Navy has been instrumental in bringing the present systems of communication in the Pacific to their present high standard. At present it maintains several radio circuits across the Pacific, the giant of which, both in length and volume of traffic, is that from San Francisco to the Philippines. There are stations at Honolulu, Guam and Cavite, while reaching to the southwest we have Tutuila in the Samoan Islands.

In Alaska we have as our principal stations Sitka, Ketchikan, Seward, Kodiak, Cordova, Dutch Harbor and St. Paul. Our Naval radio station at Cavite is in communication with French Indo-China and the Dutch East Indies, and we have commercial traffic agreements with the respective administrations.

Practically all news service in the Pacific is handled over the radio by the Navy, as privately owned radio stations are not permitted to operate in the Philippines, the United States Navy must be depended upon to carry on all communications with the islands.

But the systems of communication are not the only achievement of radio of importance, although they are the most important to the Navy. During the past 10 years commercial companies developed automatic printing telegraph equipment for the transmission over land wires of typewritten characters from one point to another. Experiments conducted by the Navy Department prove conclusively that automatic printing equipment can be applied to radio as well as to land lines. So great is the faith placed in this new system that automatic recording telegraph equipment is being installed in our high-power circuits so that by a system of relays it will be possible for the transmitting operator at Bar Harbor to press a key marked "A" or any other letter, and immediately there will be received in Washington on the radio recording apparatus the same letter. This method will enable us to reduce personnel and the number of expert operators. Further application of this method will be to aircraft where the average pilot seldom is a good operator, the recording machine making up this deficiency.

The last three years have seen many changes in radio and radio equipment. Three years ago the transmission of pictures by radio was only a possibility. Today it is a reality all because the Navy Department was thorough in its investigations.



The Olongepo Naval Radio Station in the Philippines, one of the most powerful stations in the Pacific. It handles traffic with the Naval station at Pearl Harbor, Honolulu, and the Pacific Fleet.

RADIO HISTORY

When the Navy first took up the investigation of all available types of equipment capable of transmitting pictures, sketches and handwriting, it did so with the aid of R. H. Ranger, inventor of note in moving picture apparatus. The work was carried on by the Bureau of Engineering and Naval Research Laboratories, and within a short time they succeeded in transmitting photographs over a distance of 10 miles. Now these same pictures can be sent over 4,000 miles with less trouble.

The latest triumph in this connection is the sending of photographs from England to America by radio. From 17 to 20 minutes is required for the transmission of each picture. The importance of this work cannot be underestimated, nor can it be overestimated for authentic signatures, photographs and accurate messages, broadcasting of pictures of criminals, etc. Another year will, beyond a doubt, bring about an innovation of the art.

Radio control of mobile bodies, recently perfected by the Navy, is perhaps the greatest asset to the department in time of war yet conceived. In conjunction with the work of certain inventors the Navy Department has developed a positive system for the radio control of moving craft. Experiments covering a period of two and a half years have assured the control of boilers, engines and rudder, and during the recent manœuvres at Panama, more extensive tests, the result of which will be capitalized by the Navy, were made. It is hard for the lay mind to realize that a 13,000- or 14,000-ton mass can be made to go at speeds up to ten knots, stopped and rudder movements executed by radio. Even the least imaginative mind can see the feasibility of a war at sea between giant ships unmanned and controlled entirely from the land by radio operators.

The development of control of mobile bodies on land and sea also applies to mobile bodies of the air. A whole fleet of airships can today glide into impenetrable darkness and beyond and yet make their way back to port safely by aid of radio.

At present the set installed on the F5L planes weighs 75 pounds and can communicate over distances of 400 miles with ship or shore stations and 150 miles between planes. Radio compasses are used for taking bearings in darkness or fog. Another device, which is quite promising, is the use of a piloting cable extending 15 to 20 miles from the landing field. By means of this, a plane flying toward the field, when at a distance, can be directed by the radio compass.

It is not generally known that the development of the radio by the Navy for all types of aircraft is one of its most prominent contributions to the art. Pioneer work

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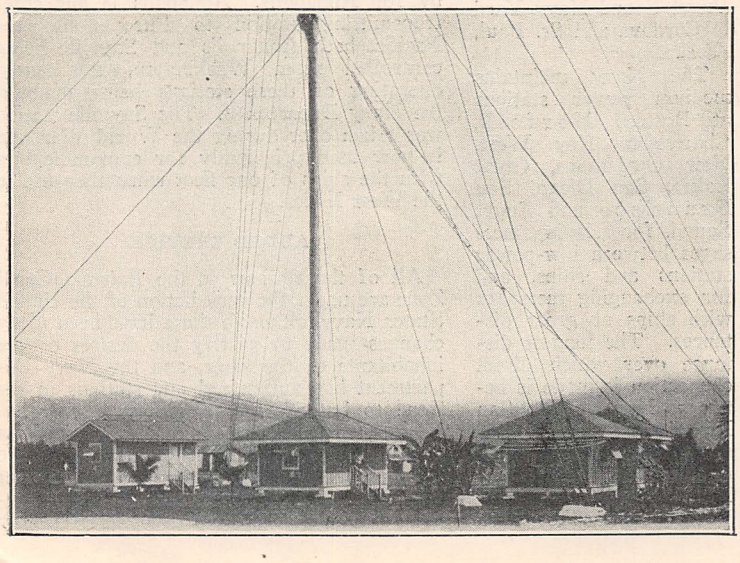
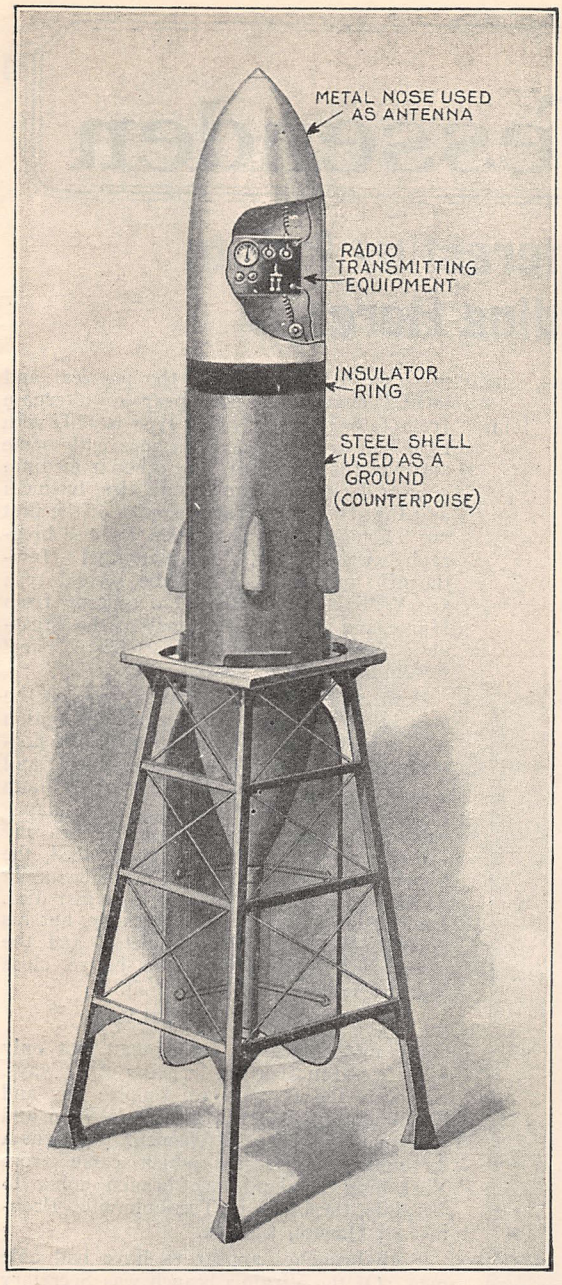


Operating building, Wailupe radio station. This houses one of the strongest radio systems in the waters of the Pacific, making possible instant communication with most any part of the world.

Is Radio Earthbound?

By D. C. WILKERSON

Can Radio Waves conquer interstellar space and travel from planet to planet? That is the question the scientists hope to answer with Prof. Goddard's proposed Moon Rocket, which will contain a radio transmitter.



The proposed design of the Moon Rocket. A radio transmitter, within the nose of the shell will send out waves continually, as the rocket takes its course.

DURING the last year, more than any other year in history, men have been given the results of scientific radio achievements which stimulate the imagination, as a spur to lagging engineering and technical development.

We have experienced the near approach of Mars, the flurry of mysterious radio impulses apparently connected with the fiery planet in some way, but the findings of this investigation have not been thoroughly tabulated from all quarters.

Professor C. Francis Jenkins, the television and telephotographic expert, made signal graphs of the electrical disturbances for the whole time of Mars' approach period, and there are other results yet to be centralized for study, from all over the world.

From scientific research and countless years of grinding labor, the human race has been able to grasp the immensity of the eternal universe to which the earth is an insignificant part. The average "man in the street" now knows that we on earth are flying at tremendous speed through the heavens, linked to the sun and the other planets, our solar system being in turn linked in some way to the greater system of tremendous stars.

Astronomers have yearned for centuries to bridge the gap beyond our own infinitesimal plane, and determine whether or not nature has peopled other worlds with living, thinking beings like ourselves. The physical limitations of space, and the force of gravity chain us to the earth, but the eye, aided by giant telescopes, has pierced the heavens and found there much food for reflection.

Even with the tremendous magnifying power of the mightiest of modern telescopes, we cannot discern on any other celestial body traces of life. The face of the moon, the nearest object in point of miles to our earth, discloses no vestige of animal or vegetable life. The greenish haze noted on the surface of Mars has not been satisfactorily observed generally.

HEAVISIDE'S RADIO WAVE THEORY

The sudden growth of radio has placed in our grasp a new force of most portentious possibilities. It is practically instantaneous. Its wave moves with the speed of light. A modern English physicist, Dr. Heaviside, has propounded the theory that radio waves are earthbound, being guided by the elec-

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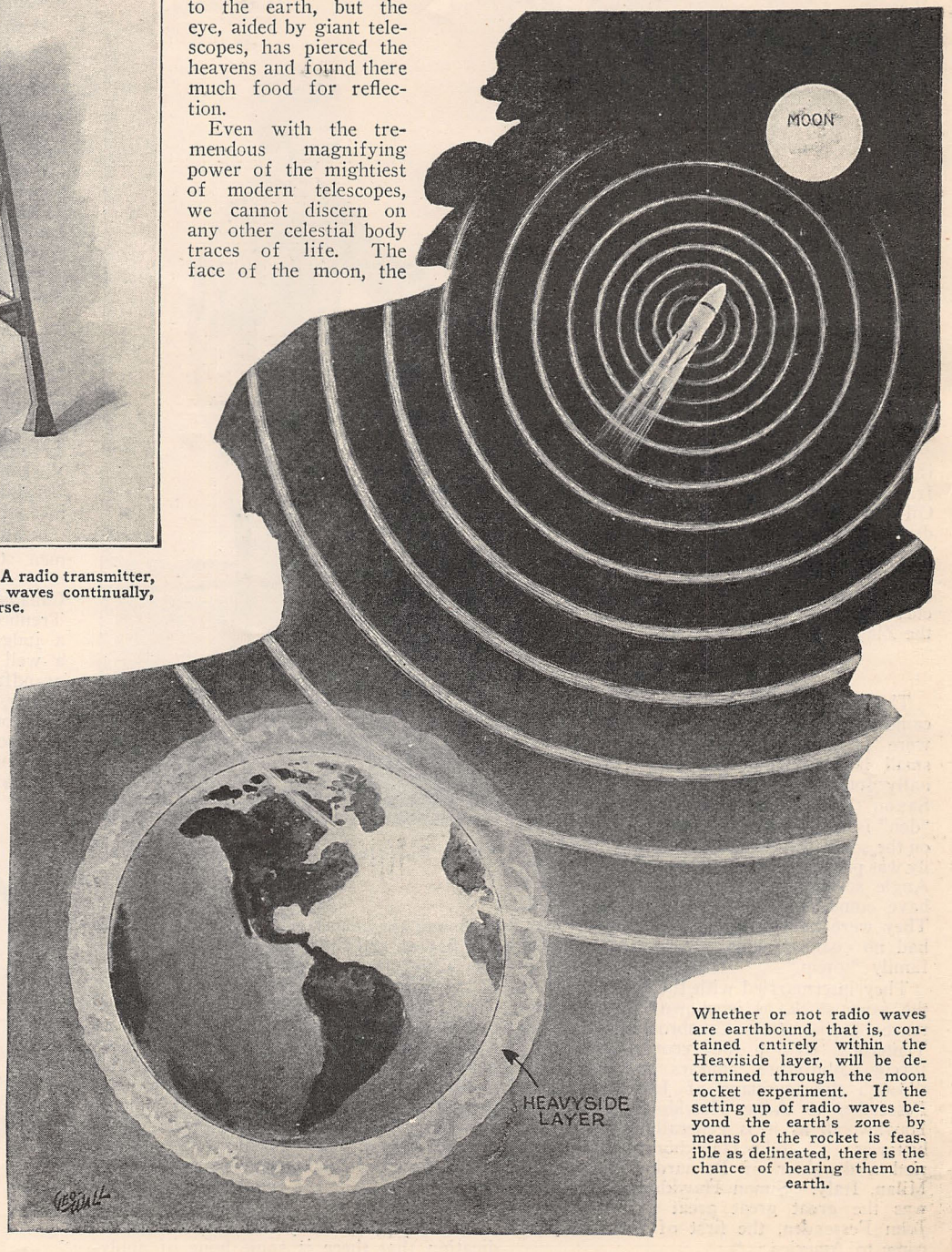

Whether or not radio waves are earthbound, that is, contained entirely within the Heaviside layer, will be determined through the moon rocket experiment. If the setting up of radio waves beyond the earth's zone by means of the rocket is feasible as delineated, there is the chance of hearing them on earth.

The Inventions of Reginald A. Fessenden

Some Interesting Points Regarding Heredity

Prof. Fessenden at five years of age.

PART III.

SOURCE OF DATA

IN our examination of the effects of heredity we have considered the race and the family group; to complete the subject we may outline briefly the heredity influences of one individual or inventor.

For the particular case the heredity data is fairly complete. It was obtained partly from Steven D. Fessenden, of the Standard Oil Co., whose father, William Pitt Fessenden, made a rather thorough investigation; partly from my father; and the greater part of it was checked personally from the records of St. Martin's church, the Registry of Wills, etc., while spending "Cricket Week" with the Zingari in Canterbury.

DATA

The family is a typical Yankee one. They came to Cambridge, Mass., in 1628. They were "men of Kent" from near Canterbury, small land-owners. The name was originally spelled Festenden. As this is good Saxon ("festen" is some sort of a fort, and "den" is valley) and the name is still found on the southwest shore of the Baltic, the family was probably descended from the Saxon or Angle settlers in Kent who are known to have come from the Baltic neighborhood. They were never distinguished in any way, had no coat of arms, though there was a family "totem."

They intermarried with their neighbors of the same stock, as is shown by the occurrence of the names Cranbrook, Rothenden, Tenterden, etc., in the records. The only foreign admixture appears to have been through the marriage of John Cranbrook Fessenden to Anne Hawkhurst . . . or Hawkwood, as it is generally given in the histories . . . John Hawkhurst having married a daughter of Bernardo Visconti, of Milan, Italy. Simon Hawkhurst Fessenden was the great great great grandfather of John Fessenden, the first of the family to come to America.

After reaching Cambridge, Mass., the line is:

Nicholas Fessenden, (nephew of John Fessenden)
William Fessenden
Peter Fessenden
Ebenezer Fessenden
Elisha Moss Fessenden
Elisha Joseph Fessenden
Reginald Aubrey Fessenden
Reginald Kennelly Fessenden

Prof. Fessenden as he appeared at military school.

Among the marriages with other Yankee families we find the usual names, *e.g.*, Sewell (the Chief Justice), who speaks in his diary of "visiting Aunt Fessenden at Canterbury," Cabot, Adams, Coolidge, etc., but none, except possibly the Cabots, of marked inventive characteristics. John Fessenden was a glover; his tan yard was on the site of the present Harvard Yard. He seems to have been rather well off for the times. His house was near the present Brattle Street, Cambridge. There were seven of the family in the Concord-Lexington fights and Peter Fessenden was in the regular army during the Revolution.

As is usual in many families, and an indication that there is some hope of applying the Mendelian laws, the physical and mental characteristics appear to alternate from father to son. One type is tall, with light hair and eyes, and has apparently some aptitude for invention. The other is medium height, dark, and tends to politics, business and the army. Typical examples of the first are Thomas Green Fessenden (whose biography was written by Nathaniel Hawthorne) and myself. Of the second type are William Pitt Fessenden, senator from Maine, and Lincoln's secretary of the Treasury; General Francis Fessenden; "Sam" Fessenden, of Connecticut.

Both types seem persistent, as may be seen by comparing Hawthorne's description of Thomas Green Fessenden with the portraits illustrating the preceding article; and my father's portrait with that of William Pitt Fessenden. The actual resemblance was very striking and close. When my father went to Canterbury, about 1884, the last of the English branch of the family which had remained in Kent, had just died. He had been mayor of Canterbury, but his portrait had not been completed, and the resemblance was believed to be so close that my father was asked to sit.

MOTHER'S FAMILY

My mother was a fine woman, not only as wife and mother but in many other ways. She was the founder of Empire day and her biography is given in Who's Who and in Canadian Men and Women. She was a Trenholme, a family which came from Yorkshire, England, one branch going to Virginia, the other to Trenholmville, Province of Quebec, Canada.

Both branches appear to have had able men. Of the Virginia branch was Secretary of the Treasury for Jefferson Davis. For the Canadians, my mother's brother, Norman Trenholme, a lawyer of Montreal, was made a judge. A second brother, Edward, was a well known surgeon. One member, my grandfather, appears to have had inventive ability, for he is credited with the grain elevator and some other improvements. He had some small mills, woolen, flour and weaving. A very large barrel of whisky always stood just outside the door in the

The Mayor of Canterbury.

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back yard with a tin cup, and any of the hands who came up to the house on business was supposed to drink what he wanted; which seems regrettable in these days.

CONCLUSIONS

The data from a few families is not sufficient to form any very definite conclusions. But, so far as it goes, it appears to indicate that inventive ability is a Mendelian characteristic and is influenced by heredity. This is all we can say at present of the first element, Heredity.

EARLY LIFE

The second and third elements, Experience and Education are best given together.

My father was born in Armada, Michigan. After the death of his brother . . . "the gallant Captain Fessenden" of General Hooker's memoirs of Petersburg . . . he graduated at McGill, Montreal, and studied divinity at Bishops College, and took orders in the Church of England. At the time I was born, October 6, 1866, he was stationed at Bolton, Province of Quebec. Later he went to Fergus, Province of Ontario, then to Niagara Falls, then to Chippewa, just above the Falls; and at the time of his death was Rector of Ancaster, near Hamilton, Ontario.

At Pittsburgh, in the nineties, there was a little club, the Monday Evening Club, of which I shall tell some other things later. Walter and Lucien Scaife, Brashear the optical instrument maker, Keeler, the astronomer, Fisher of the Underground Cable Co. and a few others were members. Once the talk turned on the first thing remembered. All gave some little wrong doing except myself, I recollected something good to eat.

Secretary of the Treasury.

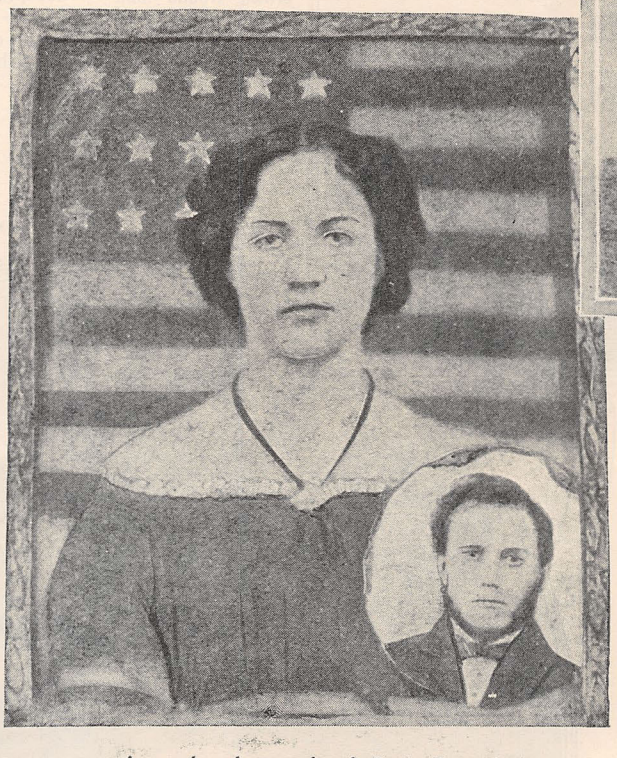
The next five minutes were taken up with a discussion as to whether one so deficient in moral sensitiveness ought to be permitted in the club.

The thing I remembered was a maple sugaring. The Province of Quebec is extremely cold in winter and I was bundled so I could hardly move. The snow was several feet deep. All around the sides of a little clearing in the pine woods were young men and girls and young married couples. In the center were some tremendous, as they seemed to me, caldrons in which the maple sap was being boiled to sugar. By each little group was a large bucket filled with snow. Big ladlefulls of the hot taffy were poured into these and the taffy was then pulled. If I were a painter I think I could paint it now; I can still taste the maple sugar, but it is beyond description. There is something in the taste of it just as it comes from the snow which is not even suggested in the maple sugar one buys.

LEARNING TO READ

When I learned to read I cannot remember, for my next recollection is of a copy, in fine print, of the Arabian Nights. In those days children learned to read earlier than they do now. My mother could read when she was five and she told me I learned slightly earlier. The present method of delaying until seven or eight would seem to be a mistake. The great character forming influences are those received before the age of seven; what a man is at seven he will probably be for the rest of his life. The Jesuits used to say that if they had the training of a child until he was seven they did not care who had charge of his training afterwards.

Now in our present civilization by far the greater part of the intellectual impulses which reach us come from what has been written; and what seem to be the more



An early photograph of Prof. Fessenden's father and mother.

important impulses can only be received in this way. If, then, we do not learn to read some years before we are seven, these extremely important impulses are missing during the age when the character is forming. I think that what is called "vision" is largely influenced by the ability to read at an early age. And "without vision the people perisheth," the prophet says.

Certainly it gives increased facility in acquiring. Many young people now, I notice, read what would have been considered rather slowly. One soon learns to read words as words and not combinations of letters, but it is possible to read lines and even short paragraphs as units and not as groups of words, so that one may read even a scientific book while turning over the pages somewhat slowly. This is a great help to one engaged in investigation and as it is purely a matter of practice it is doubtful if it can be acquired without an early start.

This brings up another point which offers a great field to workers in radio communication. Any one may satisfy himself, by placing a sheet of paper over the lower half of a line of print that when he reads

Captain Zelotes Fessenden, killed at Petersburg.

he tells what the words are by the ragged top half of the word and that he pays no attention to the lower half of the line.

Now when one makes a sensitive but powerful relay, say the relay of a good loud speaker, trace an outline of the vibrations by fastening a small pencil on the end of the relay arm, or on an extension, one gets a jagged line when one speaks into the circuit. I have found that many words can be identified, not by their individual vibrations, but by the general appearance of the short length of ragged line.

But some languages are better adapted than others. If we found a language which was best adapted for this method of recording, it would mean that we could do away with typewriting letters and simply talk our correspondence. And it would be admirably adapted for automatically recording received radio messages. The necessity of a universal language has been forced upon the attention of radio workers, now that we talk over such long distances, such a directly recordable language would be exactly what is wanted.

(Note.—Since the above was written a very interesting article has appeared in RADIO NEWS of November, 1924.)

This is a matter which amateur radio workers might well investigate. I shall be glad to make an initial subscription of $100 towards a prize for the first radio worker who succeeds in reading the sound tracings of his language, or in Esperanto or Ido, direct as words, or of his own language as modified in pronunciation.

One thing may help; I have noticed that the languages used by the mountaineers in the far east, the Caucasus and Albania, are

(*Continued on page* 1734)

Radio Service Given Over the Telephone

By THOMAS F. GILLIAMS

A most interesting description of the radio telephone service that is available in Fredonia, Kansas. This is doubtless the forerunner of many cities, which will supply to all telephone subscribers the wonders of radio.

TO take up your telephone receiver and listen in to the best radio broadcast programs without the trouble of tuning in is a new sensation, but one which new and far-reaching developments have made practical. One may now simply call Central and ask to be connected, then settle back in a chair and listen contentedly with the telephone receiver instead of the customary headphones.

But if the family as a whole wishes to hear radio music and possibly to dance to the strains of a popular jazz orchestra sent over the air, loud speaker service is also possible. An ordinary radio loud speaker can be installed in the home, connected by special wires to the regular telephone cables. All the subscriber to this new public service has to do is to turn a switch. The radio set is in the office of the telephone company.

The co-ordination of the telephone exchange with the radio broadcast station to spread this form of entertainment more widely than ever has been effected by J. A. Gustafson, manager of the Fredonia Telephone Co., which operates an independent exchange at Fredonia, Kans. While this little Kansas town of 4,000 persons has been the first in the United States to inaugurate such a service for its customers, several other towns are now following suit, and the innovation promises soon to become widespread.

What the ultimate effect of this development will be is impossible to predict. It is hardly likely that the elimination of the individual radio set is to come as a result. There remains too much pleasure for the average fan in doing his own tuning, selecting the particular station he wishes to hear, and trying for long distance reception, for any such form of standardized radio receiving to become universal. However, if the widely discussed plans for a few super-broadcast stations to take the place of the hundreds of smaller stations should ever come to pass, the opening for such a system would, of course, be apparent. Selective radio sets would be thrown into the discard, the radio service supplied by the great telephone companies would become a generally used public service. In fact, this would ultimately eliminate the radio part of radio telephony, for the phone company could easily send its programs over land wires without bothering with the ether waves. Few radio fans hope for such a day, however.

Meanwhile, the novel service supplied to citizens of the southeastern section of the Sunflower State fills in a need that does exist. There are, undoubtedly, thousands of people who either cannot afford the expense of a good commercial set and have not the time to build their own, or who will not take the trouble to tune in various stations and tune out static and other disturbances. For these people the service of the Fredonia Telephone Co. comes as a real public utility.

The radio receiving set in the office of the telephone exchange furnishes broadcast programs to subscribers free. They call, ask the regular switchboard operator to connect them, and listen in from their telephones. If a loud speaker is installed in their homes, a monthly rental is paid to the company, as a separate line is necessary for this convenience. The company connects the loud speaker in the home to its power amplifier, the lines running through the regular telephone cables. Thus radio programs are supplied without the trouble of tuning in.

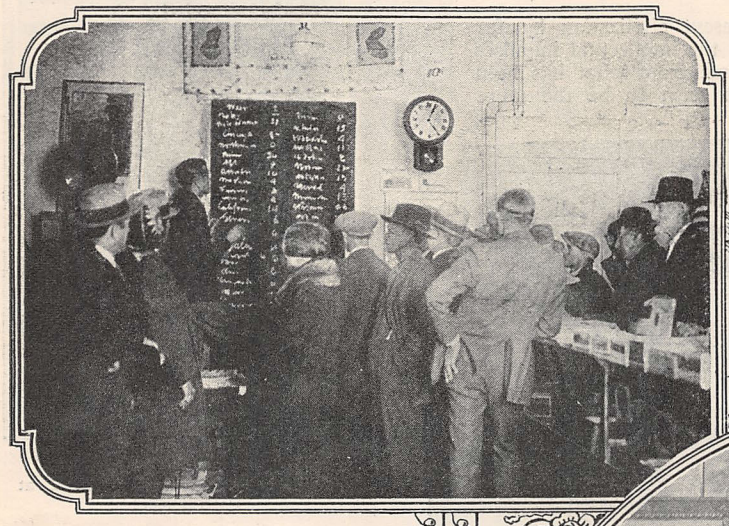
A microphone is placed in a different church each Sunday to give subscribers the local church services. Sometimes the company puts on its own broadcast programs. To show what public approval has been given the service already, it is only necessary to mention that this loud speaker service has been requested and furnished to homes that have no telephone service. Forty loud speakers are operated in a town 11 miles from the central receiving set.

Both of the political conventions were heard by these subscribers through the medium of the radio set in the telephone exchange. The acceptance speeches of President Coolidge and Mr. Davis were received most satisfactorily, and more people in Fredonia, according to the size of the town, heard the political conventions and the acceptance speeches than in any other town in the United States. Radio reports of the world series ball games and of the actual election returns were heard by these radio telephone subscribers.

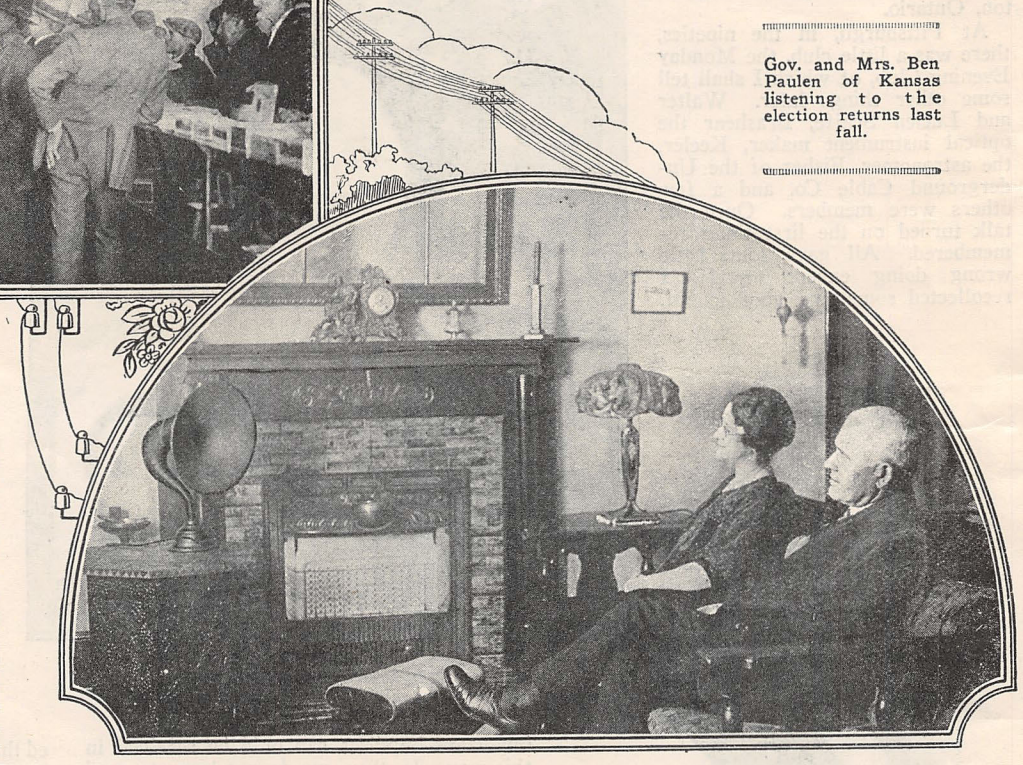
A loud speaker is installed in the same manner as the telephone, except that a small switch is connected in so that the listener can put out the horn at any time. These horns, as has been said before, are on lines independent of those serving the telephone instrument, but the regular telephone cable wires are used for the service. As many wires as are in the vicinity of the cable terminals can be connected to one cable pair.

A number of power amplifiers are used in supplying this serivce. The power from each amplifier is divided by a one-to-one repeating coil as it goes out on the lines. With five to six cable pairs on each coil, this helps to overcome the capacity of the cable. Each amplifier operates from 60 to 75 horns.

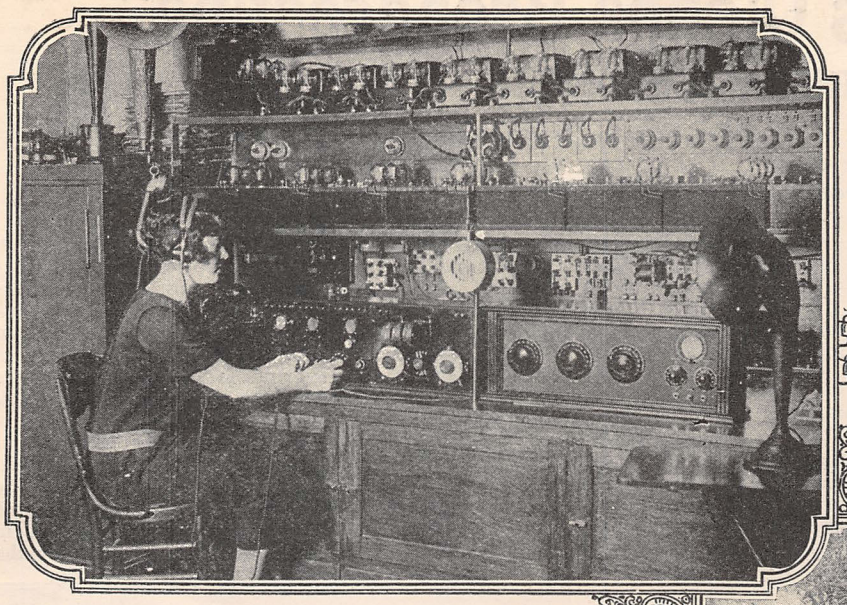
This service in no way interferes with the telephone service. While connections on the switchboard have been made so that any subscriber can call in and have the operator connect him with radio on his regular telephone, the number of those who can listen in this manner is limited to the number of cords the operator can spare.

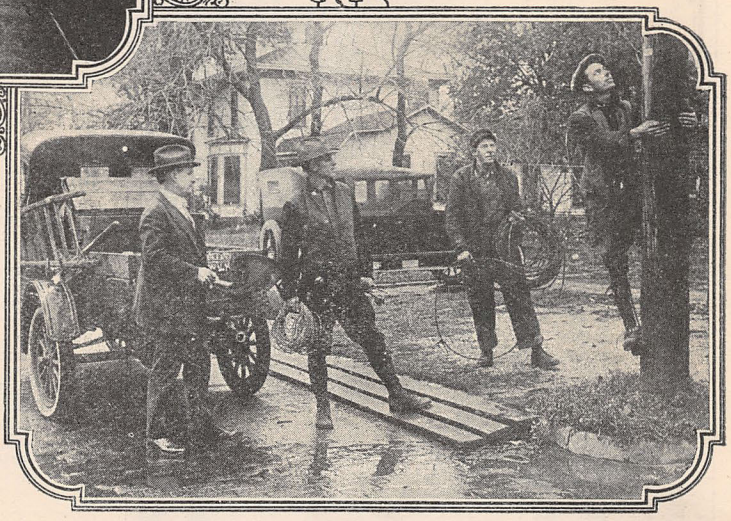


One of the subscribers to this service is a local newsstand dealer who always has a large crowd around him, when something of great interest is being broadcast.



Gov. and Mrs. Ben Paulen of Kansas listening to the election returns last fall.





throughout the country will follow Fredonia and bring to their telephone subscribers a service that furnishes radio programs with the least possible effort and expense.

At the start of this service there were many technical problems to be overcome, as well as many practical difficulties. For instance in the case of the loud speaker operation, it is easy to understand that before the number of units that would operate successfully from one output was determined, an enormous amount of experimenting was necessary. There was also the problem of interference to be considered, both from the viewpoint of telephone and radio reception. If a person were speaking over a long distance line any interference from radio signals would be extremely annoying, as sometimes the connections made are not of the best and it is difficult to understand the person at the other end of the line.

"Using this system of ours," says Gustafson, "it would be possible to connect every town in the United States possessing a telephone exchange. Think of how the people could be reached by fine lectures and other educational material. Keep on thinking and you will see new possibilities."

Miss Ruth Fuegham is the radio telephone operator for the new system, and the entertainment of the subscribers is dependent upon her tuning in. So far, she has never failed to give the best presentation possible of any program.

Gustafson himself is in doubt as to just what the future of his development will be. Although he sees its ultimate possibilities, he does not claim that it will bring any such revolutionizing changes in radio. He does believe, however, that many more towns

Above: The radio equipment of the telephone company at Fredonia, Kan. Miss Fuegham the radio-telephone operator, is responsible for the radio entertainment of people of three or four lines.

Right: "The Gang" installing wires for the connection of the loud speaker, which is being held by J. A. Gustafson, manager of the company.

Survey of Progress In Radio Engineering*

By DR. J. H. DELLINGER

A SURVEY of progress in radio reveals that this is the era of radio engineering. This statement does not refer to the importance or extent of radio engineering, but to the type of development now going on in radio as compared with that of past years. Relatively speaking, radio has been crude heretofore, whereas the progress now being made is not merely empirical, but is more largely characterized by actual engineering development. We now have, not so much the invention of devices, as the perfection of them. This statement is very general. There have, of course, been triumphs of engineering in the past history of radio, and on the other hand the process of "cut and try" will continue to be used in the future. Nevertheless, broadly speaking, radio engineering has now taken definite form and is the tool by which further progress in radio will be wrought.

While a number of outstanding recent developments arrest the attention, it is also true that very substantial progress is being made all along the line of radio engineering. Thus, in the development of new and improved radio communication methods of systems, we have marked extension of the available frequency range, great improvements in directive radio transmission, advances in the perfection of selective radio systems and engineering development of line-radio or carrier-current communication. Among radio devices and applications of radio there is outstanding progress on radio beacons, on the uses of radio for aircraft navigation, on direction finders and on radio vision. In the field of research and study of the problems of radio, we have important progress now going on in radio measurements, in standardization of apparatus, in the study and mitigation of the vagaries of wave propagation and atmospheric disturbances, and in the wide reaches of the interference problem.

THE USE OF HIGH FREQUENCIES

The most conspicuous recent development in radio engineering is the conquest of the new domain of ultra-radio or very high frequencies (short waves). Even the existence of the vast range of frequencies above 2,000 kilocycles (below 150 meters) was hardly suspected, and certainly was generally forgotten until less than a year ago. One curious reason for the subordination of this range of frequencies has been the erroneous use of wave-length in meters as an expression of radio frequencies. Radio egineering actually deals with currents which have a certain frequency. The length of the wave as it travels along in space can be calculated from the frequency, but it is a derived and an artificial concept.

Frequencies up to 20,000 kilocycles have come into extensive use. Actual radio services are being conducted in this region by broadcasters, trans-oceanic communication companies, military services, amateurs; in short, every important radio interest has begun operations between 2,000 and 20,000 kilocycles. Even higher frequencies have been used in experiments, but there is every likelihood that in the development of frequencies above 20,000 kilocycles directive transmission will predominate and the problems will be of a distinctly different character.

So important are these high frequencies now, the Third National Radio Conference, held in October, 1924, parcelled out the high frequency territory among the various radio services, thus reaching a solution of a problem which only a year ago was regarded as insoluble, that of finding more communication channels. Alternate frequency bands approximately 10 per cent. wide were assigned to the following different services: Land point-to-point, aircraft, ship, relay broadcasting, public service, amateur and army mobile. An important principle was followed in this assignment, viz, each service was protected from possible harmonic interference from stations of other services by placing the several frequency bands of any given service on its own harmonics.

BEAM TRANSMISSION

Great improvements are in progress in directive or "beam" transmission. It is accomplished by using a number of transmitting antennae and so adjusting the phases of the current in each, in relation to their distances apart, that re-enforcement of radiation is obtained in one direction and more or less neutralization of radiation in other directions. An obvious advantage of beam transmission is that much lower power is required than in ordinary radio transmission, since the transmitting power is all utilized in sending the waves in the desired

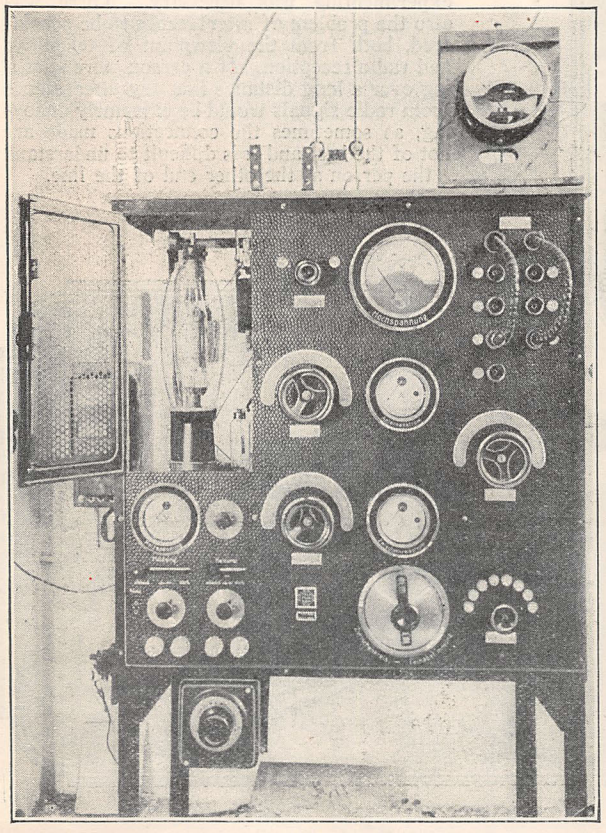
(*Continued on page* 1798)

**Address delivered before Am. Inst. of Elec. Eng.*

"Hello, This Is Vienna Broadcasting"

By RICHARD NEUMANN

A very interesting article on the organization of radio broadcasting in Vienna, where for years past broadcasting has been prohibited. The opening of this Vienna station has marked the beginning of a wide movement.



To the left is shown the transmitter panel. The door is open to show the 1.5 kilowatt vacuum tube. In the upper right corner of the panel can be seen the plug and jack system for changing wave-length. A view of the studio is shown in the right-hand photo. Note the heavy draperies on the wall and ceiling. There are two microphones, one on the table and one on the pedestal to the right of the chair.

FOR some weeks past the above call could have been received through space, with additional information that it is sent out on a 530 meter wave. Vienna and Austria now appear as members of the general circuit of all countries in which radio has already been domiciled for some years. It has entered the circle of the western culture. For several years the saying has gone about that it always requires a certain time before a cultural movement from the west can climb over the summits of our mountains, but especially in the case of radio it was not entirely our fault that we yielded ourselves in proper degree somewhat late in the day to this modern technical conquest. Bitter years of the greatest need at last are well behind us, and these restrained all developments. This was given expression also in the official opening of the new Vienna broadcast station, just as it had been pictured in other places.

ORGANIZATION OF AUSTRIAN BROADCASTING

The object of these lines is this—to give our readers a picture of the organization and the position of our broadcasting organization, because in various respects it differs materially from American methods. As has already been brought out on earlier occasions, the wireless transmission of news and comments is a monopoly of the Government, and was by the law of the 19th of February, 1924, given over as a concessoin to the Radio Intercourse Company, called for short, RAVAG. Besides the general Government, the Corporation of Vienna, two banks and several of the largest radio firms of Austria, have an interest in it. The President is Dr. Anton Rintelen, Governor of Styria. The preliminary organization work at the time of the initial operations of the broadcast station, which was on October 1, were pushed so far that the fees for the participators in the broadcasting were ready to be given out. The pioneer work has already, during some months, been carried out on unselfish lines by the broadcast station "Radio-Hecaphon," which instituted the transmissions on the same days. The proper conclusion had been reached by the authorities in charge that participation in broadcasting must be made possible for the people at large. To carry this out, taxes amounting per month to 20,000 kroners were levied on those whose monthly income did not exceed 7,000,000 kroners (exchange value about 70,000 kroners to the dollar) which made up about 95 per cent. of the receivers of the broadcasting. The owners of a receiving set who have an income exceeding this amount have to pay 60,000 kroners a month. Manufacturers of and dealers in radio apparatus and accessories have to send each month the sum of 320,000 kroners to the broadcast station. Smaller dealers have to obtain for their shops a printed license and naturally all these arrangements involve the direction that every owner of a receiving set shall announce it to the broadcast station, which can be done in the simplest way through the nearest post office. Up to the time of the opening of the daily broadcasting, 15,000 subscribers had enrolled, while this number, according to the last news, has already amounted to 25,000, certainly a very pleasant sign of the interest in the broadcasting movement in little Austria, which under the present conditions consists almost entirely of

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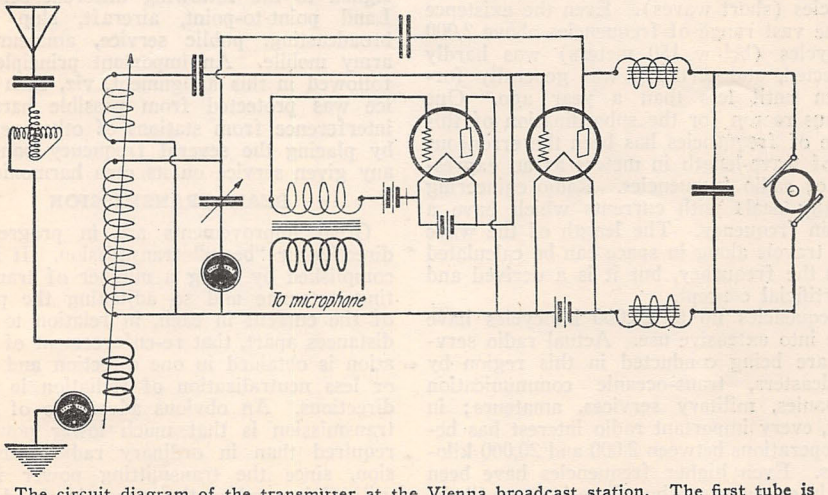


The circuit diagram of the transmitter at the Vienna broadcast station. The first tube is employed in the modulator circuit and its function is to change the resistance of the grid-filament circuit of the oscillator tube.

How Radio Is Lifting the Level of American Women's Cookery

By MRS. CHRISTINE FREDERICK

Radio is offering to the housewife the opportunity of furthering her education in the culinary art. At the present time she can pick her recipes from the air and proceed with the cooking of dinner with the satisfying feeling that she knows what she is about. Radio may yet eliminate indigestion.

WHEN the late Sarah Bernhardt visited the United States, she was scandalized at American cookery. French women are, of course, the best cooks in the world, with Italian, German, Swiss and Danish not far behind. America has long been a benighted country, so far as cookery is concerned, as any traveling salesman can tell you. Yet even a traveling salesman is a poor judge, for he eats poor combinations and sticks to a narrow range of food.

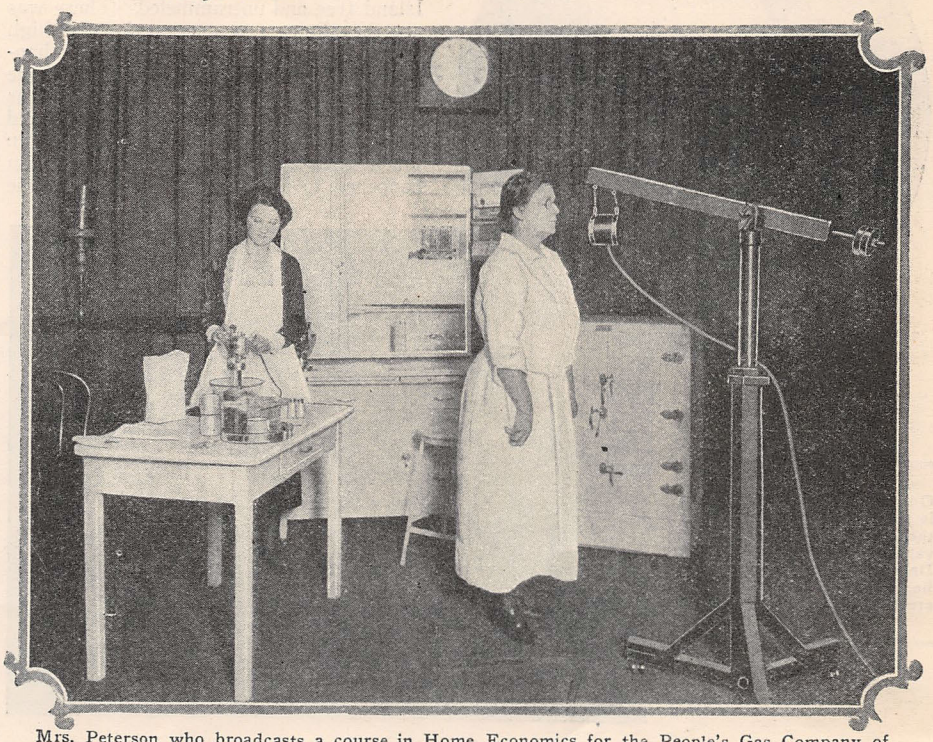
RESORT TO FRYING PAN

The blunt truth is that American women are poor cooks, even with a greater variety of food available and more money to spend for it than any other nation. The frying pan has been her refuge and her constant tool, whereas frying pan cookery is the sure road to indigestion. One reason American women rank so low in the international culinary contest is that they have had a false idea of the menial nature of cooking. American girls know little or nothing of cooking because their mothers have so often sought an idle, parasitic wifehood for their daughters.

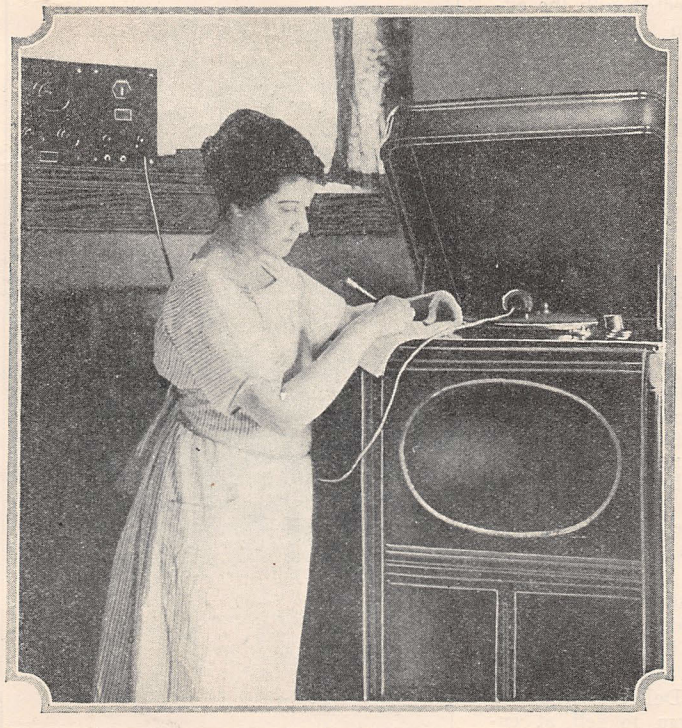
But the modern girl has not so much of this false idea; and even modern mothers are reading more and learning more.

The radio is amazingly hastening a change in American women's knowledge of cookery, because the isolated millions of women in city and country, who read no papers and stay at home most of the time, have, through radio, come in contact with educative forces.

Few of us who tune in on radio for music or address realize what is going on. There are now half a dozen *radio* cooking schools, *each of them with more women students by far than the largest university in the country.* Kansas State Agricultural College has a home economics course which reaches women, not only in Kansas, but in a huge circle, some of them even in Canada. There are enrollment cards, examinations and certificates at the end of the course.



Mrs. Peterson who broadcasts a course in Home Economics for the People's Gas Company of Chicago through Station KYW. © Phyllis Frederick Photo Service.



Today the housewife can get her recipes via radio and learn considerably more about cooking in the bargain. Radio cooking courses are being broadcast from a number of American Educational Institutions. © Phyllis Frederick Photo Service.

RADIO COURSES IN COOKING

There are also other such courses in cooking, each with a huge following. There is WLAG, a radio station in Minneapolis, owned by the Gold Medal Flour Company, which naturally has a special reason for keeping women interested in cookery. It also has special courses of eight lessons on cooking, the women registering for the course, and receiving, in addition to the broadcast lessons, printed cards containing recipes. A certificate is also awarded those who complete the course satisfactorily. A quite remarkable line of other lectures are given for women on meal planning, practical nutrition, home management, beauty, dancing and culture.

Another excellent example of a radio cooking course is the one operated in Chicago by the Peoples' Gas Company. Certificates are also awarded, and the women enrolled are given radio recipe note books, with spaces to write in the broadcast recipes. Food talks are given daily at Station KYW at 11:35 a.m., and a "friendly help" plan is operated personally over the telephone to listeners-in. Personal lectures to 10,000 women per week are also given at the company's offices. Uncounted thousands of Chicago women, rich and poor, listen in and the "radio teas" which were staged have proven big successes.

Here, then, are examples of what is going on among at least 1,000,000 women who, because they like the sound of a human voice in preference to dry print, are stimulated to better cookery to a degree never attained before. The well-to-do women of the Nation have for years had "home economics" divisions of women's clubs and other such occasions to hear talks on cookery, but nine-tenths of the women of the country either had to get their knowledge haphazardly or learn it from print, which is notoriously hard for the average woman, especially when attempted all by herself.

FOREIGN WOMEN LEARNING MODERN COOKERY

Radio has been a boon, especially to the millions of foreign-speaking women, rather

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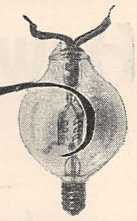
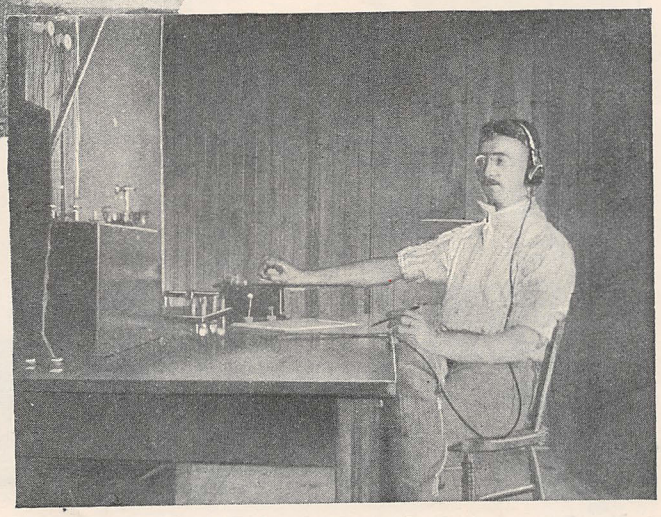
The Life and Work of Lee DeForest





One of the old-time stations is shown at the right. Note the operator tuning the big variable condenser. Above, Dr. DeForest is shown as he appeared directing the erection of a Florida station.

PART VI.

"I'M representing the *Providence Journal*," said the gentleman to De Forest. "We have been interested in your work for some time and wondered if you would be interested in forming a contract with us for the erection and operation of a couple of wireless telegraph stations on the coast near Providence and on Block Island. During the summer season we have a large number of subscribers on the Island and the business of giving them news up to the minute is slow and expensive."

While he was talking to DeForest, the latter had a stiff time keeping his enthusiasm from showing itself. And business men are not greatly impressed or easy to deal with when too much enthusiasm is shown on one side of the bargain. But with a little control, DeForest was able to make an acceptable contract and arrange for the installation and operation of the two stations. Accordingly, a contract was placed for the transformers and a couple of second-hand gasoline engines were bought in Broome street.

In a very few weeks after the visit of the gentleman from the *Providence Journal*, everything was in running order and the people of Block Island were receiving their news almost as quickly as the people of the mainland. The Point Judith station, on the mainland, was kept in touch with the editorial office of the paper by land line, and as soon as the despatches arrived they were sent to the Island station and posted in the form of bulletins for the use of the public and appeared in the small daily paper then published.

DISCOVERY OF THE FLAT-TOP ANTENNA

This was in the spring of 1903. Everything went well for the remainder of the spring, but during the summer there was a great deal of static, enough to interfere at times very seriously with the one-kilowatt of power being used at the transmitter. Moreover, high winds swept the Island free and untrammeled. There was not the slightest protection for the high mast of the station. The inevitable happened. During a heavy storm down came the mast of the station and great was the fall thereof. The operators looked about for some means of keeping in touch with the land station. DeForest happened to be on the scene at the time of the disaster. He spotted the telephone.

In less time than it took to throw over the big change-over switch, the receiving apparatus was connected to the long land line which connected the station with the village in the direction of Pt. Judith. To the surprise of everyone connected with the experiment, the signals from the land station came in *booming*, louder than they ever had with the old antenna.

And so, through the merest accident, the use of the directive flat-top antenna was thus discovered in 1903 on Block Island by Lee DeForest. From the station, which was situated on the coast of the Island, the telephone line ran a straight seven miles to the village and at no point along its route was it more than a few yards above the surface of the earth. It formed an almost perfect type of the directive antenna which is now employed at all the large trans-oceanic stations.

Following this incident, of course, the old time mast was again installed, but the telephone line was cut in as the receiving antenna every time atmospheric or other disturbances caused the signals to fade. This observation was carefully noted and worked upon later. DeForest thought there was nothing in it that could be covered by a patent, so the only course was to keep the idea quiet and reserve its use for the company.

Much wide publicity had been given these first newspaper stations on account of the far reaching possibilities in connection with the journalistic field. As a consequence, the stock of the American DeForest Wireless Telegraph Company began to sell at encouraging figures. Conditions were again looking upward.

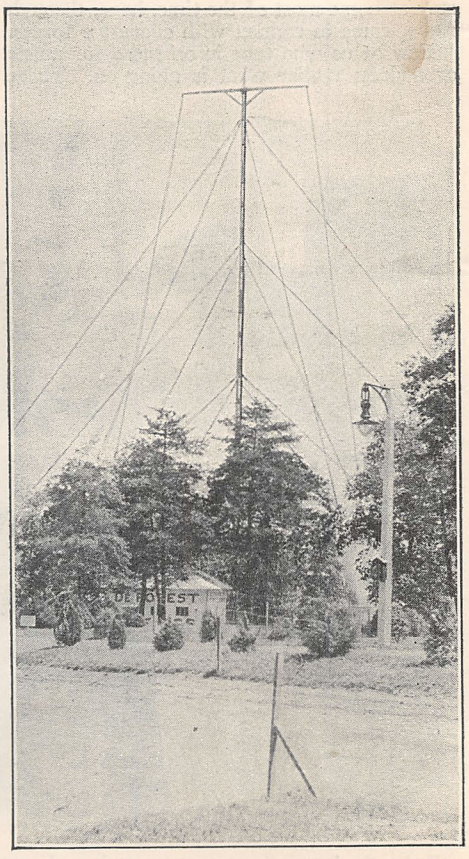
ANOTHER CALL FROM THE WAR DEPARTMENT

Then came another call from the War Department. Manœuvres were to be held again, this time off Fishers Island. One year before they had employed DeForest apparatus to keep the shore officials appraised of the movements of the vessels, and asked for the same arrangements again. Accordingly, a tug was equipped with a large transmitter and given to the charge of a couple of dependable operators. The old stand-by shore station at Coney Island was again called into service to handle any of the traffic that might be picked up so far west.

On the day set for the beginning of the sham battles, the little tug pulled out of the harbor in the wake of a couple of battle cruisers. On out to sea it went, keeping in constant touch with the ships and the fort. The trial was perfect. Not for an instant were the two stations out of touch with each other. The brusque old Signal Corps men, practical and hard boiled as they come, stayed close to the apparatus and were actually taking it and the operators for granted before the completion of the test. They simply could not be impressed, even by DeForest's magic wireless.

SIR THOMAS LIPTON EMPLOYS DE FOREST'S APPARATUS

But to go back to the early spring of 1903, another challenge for the American cup had come from England from Thomas Lipton. He built his *Shamrock III* and had great faith in her. He was sending the new boat with his steam yacht *Erin* over as tender as soon as the American end of the arrangement could be completed. He cabled DeForest



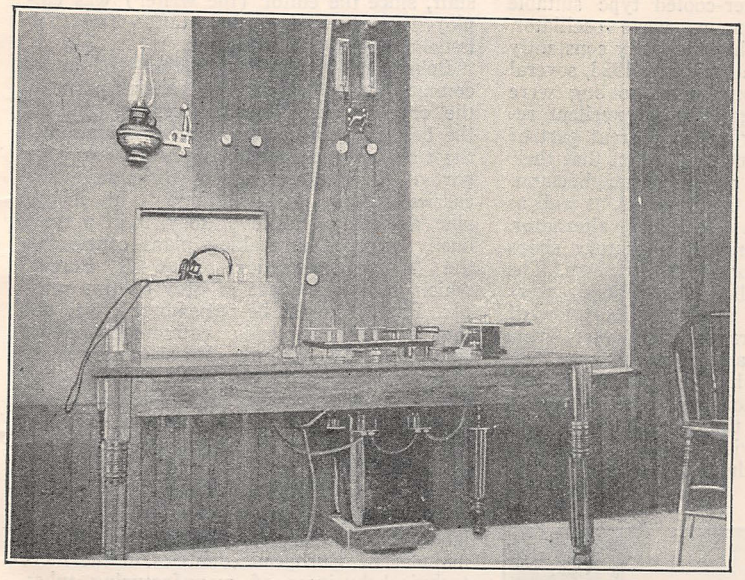
The high power DeForest radio station.

Biography recorded by W. B. Arvin of Radio News, *under the personal direction of Dr. DeForest. Copyright 1924 by E. P. Co.*

to send one of his representatives with a complete wireless set to be installed on the steam yacht. He had been besought to install Marconi apparatus, but had insisted that the American system was the only one for him. So DeForest rigged up the most beautiful and perfect one-kilowatt transmitter the world had ever seen and sent it over to be installed. His operator, Harry MacHorton, made a notable installation at Glasgow and started with the crew on the trip. As soon as he cast off, he cabled his co-workers at the Coney Island station so that they could be listening in as soon as the yacht came within range. For more than a week, the two operators at Coney Island divided the days into shifts and sat before the instruments vainly listening for the signals from the yacht. The weather during the passage was rather heavy and, as a consequence, the Lipton flotilla was delayed. Finally, early on the eighth day, just as the operators were changing shifts, a faint tickling noise disturbed the constant frying in the phones connected with the electrolytic detector. They sat tensely. After a few minutes the signals cleared and the call of the yacht made itself clear.

Immediately the pent-up expectancy of a whole week made itself evident. The operators fell upon each other's shoulders and wept.

The yacht was about 90 miles out when it was first heard. During the remainder of the journey the Coney Island station constantly exchanged messages with the yacht. As soon as anchorage was found, Sir Thomas set up his headquarters on the *Erin*, anchored off Sandy Hook, nearly 40 miles from New York. With the race yet six weeks off, his only method of communication with his other principles in New York was through the medium of the station on the yacht and the DeForest station at Coney Island. All his cable messages followed the same routing.



Above: The demonstration station of the DeForest system at the St. Louis World's Fair, 1904. At the left: Another old-time station; note the large transformer under the table.

COMPETITION AGAIN

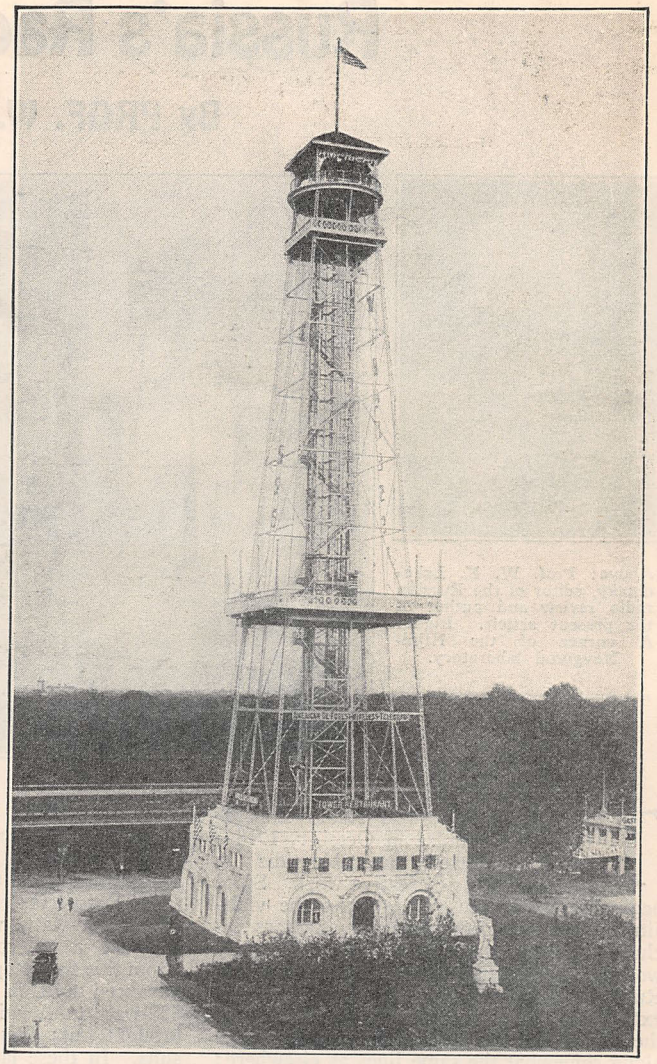
For the races themselves, the Marconi Company had a contract with the Associated Press to furnish the news despatches from a tug which was to follow the races. And, as two years previously, DeForest also had a contract with the chief competitor of the A. P. But there was another wireless company wishing to enter the list and pick some of the publicity plums. This was the corporation employing Harry Shoemaker and Prof. Pickard. The only hitch was that there were no more press agencies with which they could contract. As a result, the only action left for them in the emergency was to hopelessly jam the other stations as they tried to work. Accordingly, they chartered a large brick schooner and equipped her with a two-kilowatt station, with 130-cycle generator and transformer. The masts of the schooner were high and turned out to be mighty radiators.

DeForest was, of course, not allowed to use the station aboard the *Erin* because of her ownership, so he had again to erect a temporary station aboard another tugboat and with it followed the progress of the racers. The brick schooner could not move about the harbor agilely with the power of her sails, so Shoemaker hired a tugboat to tow her. The Associated Press and the Marconi Company employed another tug for their purposes. It was a motley crew of tramps and rigging that left the bay early on the first morning of the races for the course. The two press boats were intent on success and the brick schooner and her crew were just as intent on causing failure for the other two. And so the day began.

INTERFERENCE FROM THE SCHOONER

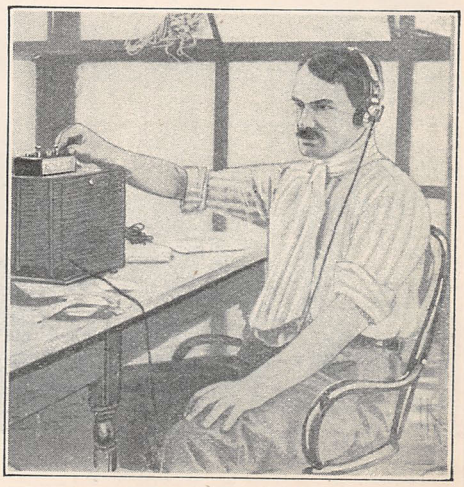
As soon as the preliminary reports began to come in, the two kilowatts on the schooner let loose. And, in the words of the operators, "It certainly tore the ether all to hell." None were able to receive so much as one complete code word.

For a half hour or so, Pickard and his accomplice sent rambling sentences, single words—anything they could think of handily to pound out into the ether. Pickard, however, was somewhat of a poet and he called to mind Scott's "Lady of the Lake." No sooner had he begun to call up the lines in his memory he began to give the other operators listening in a lesson in English literature. Complete, it was, even to the capital letters at the beginning of the lines and the flourishes between the Cantos. When he tired, his pal, Shoemaker, filled the ether with English, not so classical as profanely expressive!



DeForest knew something would have to be done immediately if his dispatches were to be gotten across. The old Wehnelt interrupter was still in the kit. He hauled it out anl connected it in the circuit. Immediately the high pitch of the note made it readable through the crushing power of the schooner. The only trouble was that there was no platinum wire for the interrupter, so a steel stay wire from the boat had to serve. The acid solution ate it off so quickly that a deckhand had to stand over it with a small hammer and keep it in place. The transformer being used was a two-kilowatt one, and delivered 30,000 volts at the secondary. The weather was comparatively rough and the tug was small. Soon the sea

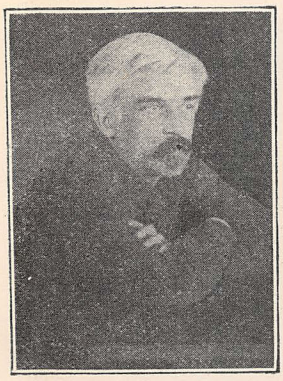
(*Continued on page* 1778)



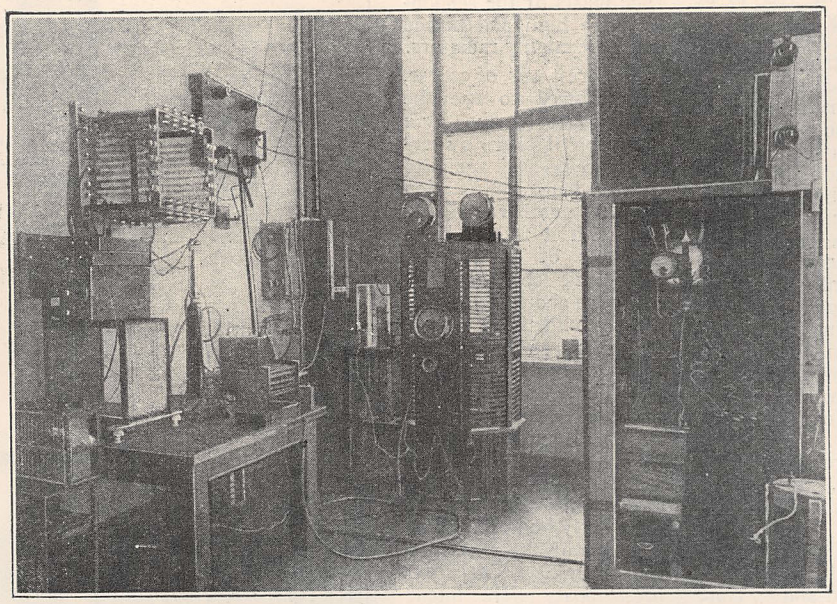
The first of the stations using the wedge electrolytic detector.

Russia's Radio Laboratory

By PROF. W. K. LEBEDINSKY



Above: Prof. W. K. Lebedinsky, editor of the Russian radio review and author of the present article. Right: A corner of the Nijni-Novgorod laboratory.



M. A. Bontsh-Brujewitsh, Engineer of the Russian Laboratory who has contributed largely to the design of high powered vacuum tubes.

THE Nijni-Novgorod Radio Laboratory was founded in October, 1918—not a particularly favorable time for the inception of creative work. Since beginning work, however, despite the vicissitudes, the engineers and investigators included in its staff have been constantly working toward the betterment of radio in Russia. Being separated and to a certain extent out of touch with the remainder of the radio field, the laboratory work has been along somewhat the same lines as elsewhere; that is, paralleling work being done in some other countries.

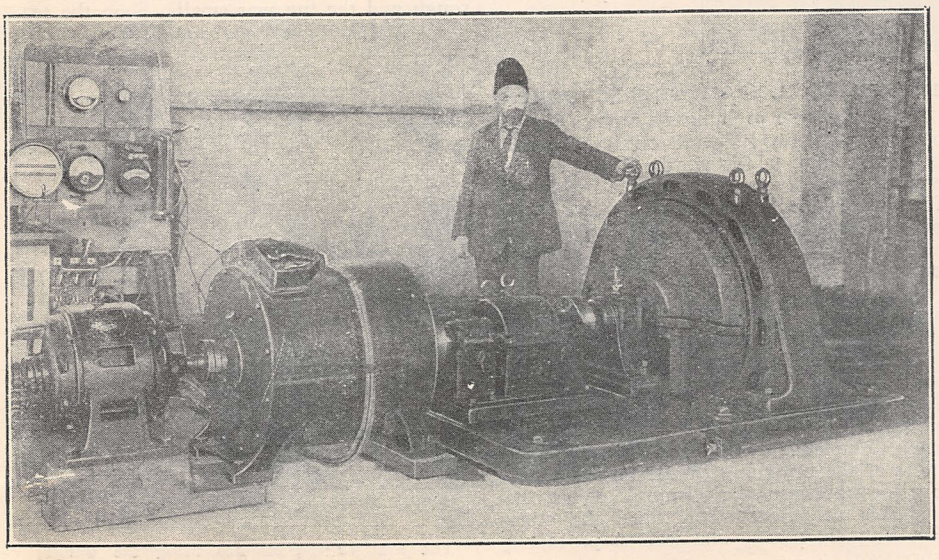
Mr. M. A. Bontsh-Brujewitsh, an eminent radio engineer and one of the chief engineers of the laboratory, has been at work almost constantly since the foundation, upon various types of vacuum tubes. Toward the end of 1919, he brought out the laboratory's first amplifying tube. The results obtained with it, however, were hardly sanguine, since the plates were made of aluminum. A great part of his time was occupied, aside from his constructional work, in annotating the various theoretical points as well as difficulties encountered in the construction and design of tubes.

THE FIRST WORK

Up until this time, very little attention had been given to the larger sized tubes, such as are used in C.W. transmission at the present time. Before the end of 1919, he had brought out a 100-watt, water-cooled type suitable for use as a continuous wave oscillator From this first step, the laboratory constantly advanced until, in the spring of 1923, several 500-watt tubes without water cooling were brought out; these gave most excellent results. In these latter tubes, a great part of their efficiency was due to the fact that their plates were made of a special molybdenum-tantalum compound. These tubes, as well as a 150-kilowatt high frequency alternator, were built entirely in the laboratory shops and under the direction of its engineers. The first tests on long distance telephony were made a few months after the inception of the laboratory. Transmission was from Moscow to Irkutsk and Chita.

Such a reputation has been gained by the workmanship and efficiency of the laboratory that today most of the Russian radio stations are equipped with its apparatus. The most powerful of the stations, situated at Moscow, uses the laboratory apparatus throughout. *Telegraphija i Telephonija bez prowodov,* the chief journal of radio telegraphy and telephony in Russia, was established early in 1918. At the beginning of the laboratory work it was taken over by the staff, since the editor (the writer) was employed on the laboratory staff. The 27th issue appeared in December.

Being one of the few methods of intercommunication between the various parts of the country and experimenters, it contains the best radio news, technical problems and the work of the various engineers. A good part of the text is made up of experiments carried out in the laboratory. This magazine, as well as the laboratory, is at present busily engaged in making plans concerning the Jubilee celebration of A. S. Popoff, which is to take place in May of this year. Mr. Popoff, it will be remembered, was the first to illustrate radio communication on May 8, 1895, at the Russion Physical-Chemical Society in Petrograd (Petrograd has been recently renamed Leningrad). He showed before a large collection of scientists the first disclosure in Russia of the principles of radio.



A view of the 50-k.w. high frequency alternator of Mr. W. Wologdin's system.

POWER TUBES

But again to the present work of the laboratory. Being woefully behind the remainder of European countries in the mere technical business of manufacturing tubes, no small amount of experimentation and investigation was needed before the work could have advanced. Mr. Bontsh-Brujewitsh first turned his energy to the development of the formation of the elements, experimenting with a great number of compounds and metals. From these investigations he passed to the search for effective means of pumping the tubes. In the smaller sized tubes, after the use of the mercury pump, he found that there was a gas residue which caused difficulties. His investigations brought him to a very effective means of circumventing this difficulty. A small glass bulb, holding an aluminum capsule filled with sodium and potassium, was sealed to the tip of the tube before complete evacuation. After the main part of gas had been removed, a powerful electric furnace was used to melt down the capsule and so release the vapors of the earth metals. This was made more efficient by passing the vapors through a small jet which formed itself automatically in the

process of blowing the gas bulb. Following this step, current was placed in the tube after the regular fashion and the electron discharge ionized the metal vapors.

Mr. Bontsh-Brujewitsh's explanation of the effectiveness of this method is that the residue left after the completion of the pumping process is the result of a partial disintegration of certain chemical compounds

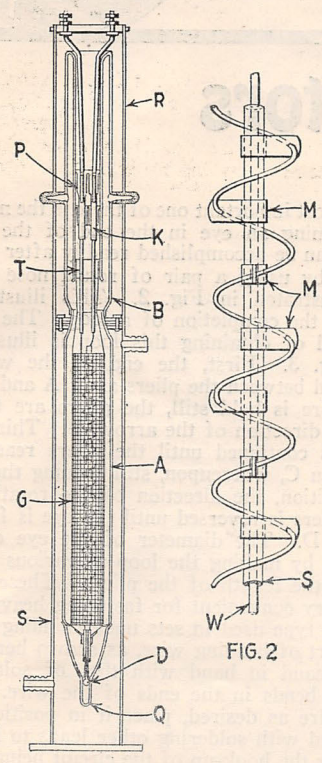
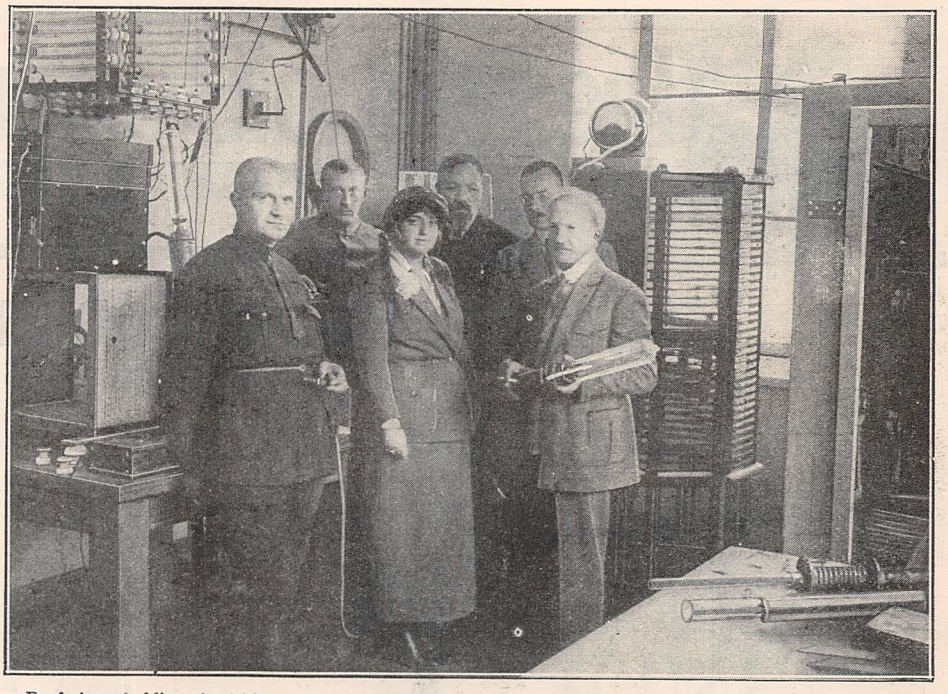


FIG. 1

Showing details of the water cooled power tube developed by M. A. Bontsh-Brujewitsh and shown in the photo below.

FIG. 2

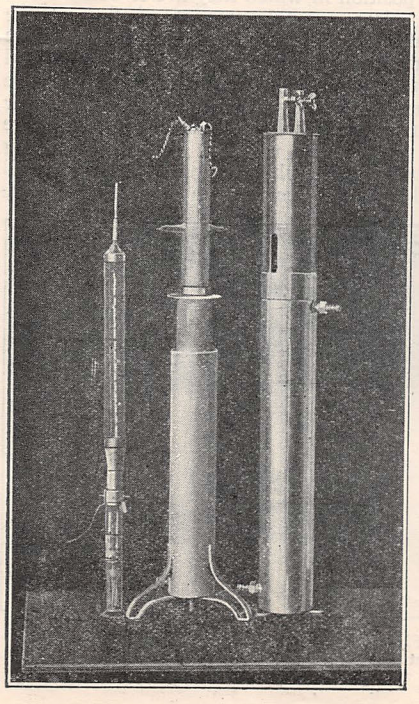
which compose the tubes' elements. The sodium vapors tend to accelerate the disintegration and to unite with the products released. After the addition of the sodium vapors the sealing process causes them to deposit in crystalline form upon the glass walls. Later an additional heating will cause this crystalline substance to unite with the glass of the bulb. The completed tube can be burned at high temperature and with extremely high plate voltages without the appearance of any further gas.

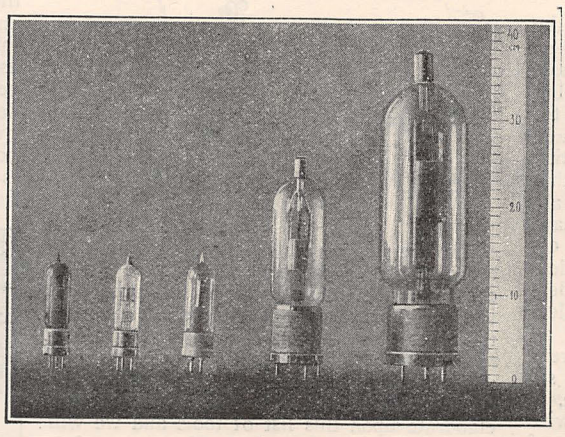


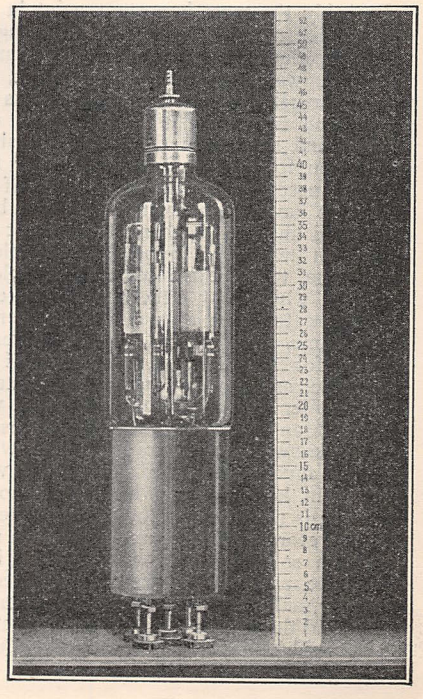
Prof. Arco holding the 25-k.w. tube during his recent visit to the Radio Laboratory at Nijni-Novgorod.

Some surprising increases in the power of the tubes evacuated in this fashion have been obtained. In dealing with the small amplifier and detector tubes, Mr. Bontsh-Brujewitsh discovered some conditions which led him to the use of manganese instead of the sodium or potassium. However, for the detector type, he found that sodium had a few advantages in increasing the tube's sensitiveness. From the very first, the laboratory workers have been very much interested in the production of large power tubes. Mr. Bontsh-Brujewitsh has given a great deal of his attention to this question with some surprising results. One of the most novel designs of power tubes, water cooled, is that developed by him and shown in Figs. 1 and 2. The plate is a copper tube sealed to a glass tube. The grid is made of molybdenum and held over a tungsten carcas. The filament is a straight coarse tungsten wire supported in the center of the grid and plate. Around the outside of the plate is a second metal cylinder which carries water. The tips for carrying the various leads of the tube are sealed on to the first glass tube attached to the plate. The tube consumes 42 amperes at 50 volts for the filament. At first it delivered 25 kilowatts and later the same design with a few minor changes delivered 35 kilowatts. The plate voltage is approximately 9,000, while a plate current of 15 amperes was possible. From this beginning other larger types were designed which delivered as high as 81 kilowatts. The operating time of these tubes runs 700 hours or more, no complete tests having been made. At the present time Mr. Bontsh-Brujewitsh is interested in the development of a new tube to radiate 100 kilowatts.

It will be seen from the foregoing that Russia is not so far behind in her radio investigations as might be thought, although there is not the general practice of broadcasting and the large number of experimenters here as in many other European countries, but those who are interested in this newest of the sciences are forging constantly ahead.







Above: Some of the tubes developed by M. A. Bontsh-Brujewitsh in the Nijni-Novgorod Laboratory. The first two tubes are amplifiers of the thoriated filament type and the other three are power tubes of 10 watts, 150 watts and 500 watts respectively.

Left: A 25-k.w. water cooled tube. Right: A 3-k.w. tube.

Hints to Radio Constructors

By A. P. PECK

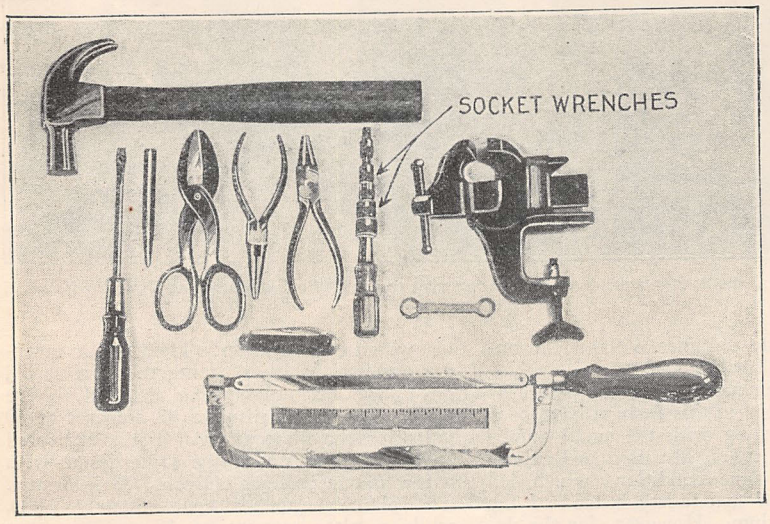


Fig. 10. If you expect to do a real good job in constructing a radio set, the tools shown in this photo are essential. It takes more than the hands and a pair of pliers to do such work well.

IN this article the writer is not going to give directions for building any particular set, but is rather going to describe, for the benefit of the readers, the proper method of going about the assembling of sets, stressing particularly the tools needed and the methods of handling them. One who has been contemplating building a radio receiving set will undoubtedly find below some hints that will be of value in the work. Whether you are thinking of building a simple crystal receiving set or a multi-tube Super-Heterodyne, you will have to know certain fundamental principles of construction. These will be outlined in the paragraphs below in as simple and concise a manner as possible.

SOLDERING TOOLS

Probably the most important point in the construction of radio sets is the soldering of the connections. It may seem very simple when you watch someone else doing it, but when you get the necessary implements together and try to do it yourself, you will usually find it to be a different proposition unless you follow certain definite rules that are very necessary for success. First of all, you must have the correct tools. We have illustrated in Fig. 1 those tools most essential in making a good job of soldering. The tools illustrated are a soldering iron, which may either be of the electrically heated type or one heated over an open flame, two extra tips of different shapes, for the iron, a small box of sal ammoniac and one of soldering paste, a medium file, a pair of pliers and some wire solder. Many constructors prefer the use of what is known as resin core solder in which resin or flux is contained within the wire. This form, however, is rather difficult to use until one is proficient in the art of soldering and, therefore, it is recommended that a non-corrosive soldering flux or paste, as it is called, be used. The flux is employed in order to make a perfect union between the solder and the metals to be soldered together. Its use will be explained below. Without it, ordinary soldering would be impossible.

The purpose of the various tips for the soldering iron is that by the use of them heat can be applied to points that otherwise could not be reached with the standard tip. These accessories are not absolutely necessary, but are desired as they are often found to be quite convenient. The small box of sal ammoniac is for the purpose of cleaning the iron. Rub the iron on the salt occasionally when in use, to keep it clean. The file is for this purpose also and the pliers are used for holding the materials to be soldered. Of course, one can elaborate upon this list of tools and we will mention this fact later in another connection.

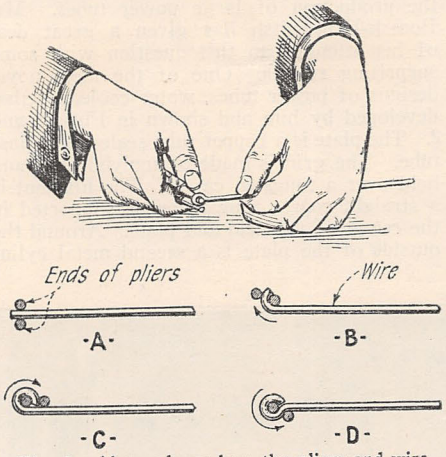


Fig. 2. Above shows how the pliers and wire should be held, and Fig. 3 how the pliers are twisted to loop the wire.

BENDING WIRE

In most of the radio receiving sets in use today either solid copper wire of about No. 14 gauge or what is known as bus bar wire is employed for connecting the instruments together. This material finds favor because of the fact that very neat connections and solid joints can be made with it. In order properly to use this material it is desirable that certain points in working it be learned. The most important one of these is the method of turning an eye in the end of the wire. This can be accomplished readily after a few trials by using a pair of round nose pliers as illustrated in Fig. 2. This illustration shows the completion of a loop. The exact method of obtaining this loop is illustrated in Fig. 3. First, the end of the wire is gripped between the pliers as at A and while the wire is held still, the pliers are turned in the direction of the arrow, B. This rotation is continued until the pliers reach the position C, whereupon, still holding the wire in position, the direction of the rotation of the pliers is reversed until the eye is formed as at D. The diameter of the eye can be varied by making the loop at various points along the length of the pliers. These loops are very convenient for fastening heavy wire of the type used in sets under binding posts. The art of bending wire, as shown herewith, goes hand in hand with that of soldering. Make bends in the ends of the wire, shape the wire as desired, place it in position and proceed with soldering other leads to it, following the hook-up of the circuit being used.

SOLDERING

We will now consider the subject of soldering. The first and most important point to remember is that cleanliness must be observed throughout the process. We will take up the steps in order. First, if an electric soldering iron is used, connect it to the source of current or if the other type is used, place it over an open flame. For small irons, an alcohol torch can be employed as illustrated in Fig. 5. While the iron is heating, carefully clean the wires to be soldered together. Sandpaper will accomplish this very easily. Then remove all traces of sand, place the wires together in the position in which they are to be soldered, and place a small amount of flux at the joint. As little flux as possible should be used as it then tends to make a cleaner and neater joint. The right amount must be determined by experiment. By this time your iron probably will be heated, but take care not to let it get red hot. When the heating is being done with an open flame, you will find that the iron is at a right temperature

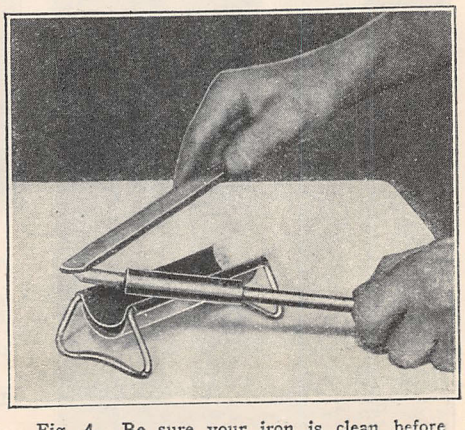
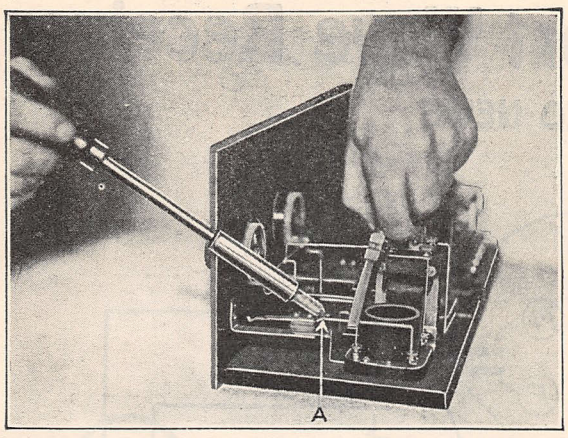


Fig. 4. Be sure your iron is clean before attempting to solder with it. A file will scrape the dirt off.



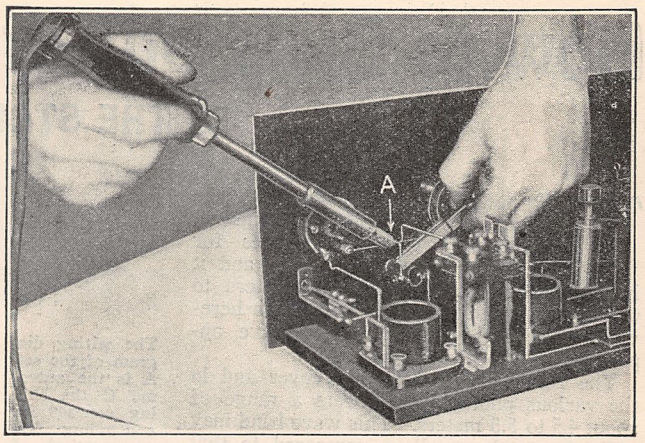


Fig. 7. Left: The correct way to solder the end of a bus bar wire to a terminal. Grip it with the pliers to hold it steady. Fig. 8. Pliers are essential when soldering a joint like this.

a short time after a green flame starts to play around the edges of it. Place the iron on some non-inflammable material such as a holder as illustrated in Fig. 4, and with the file clean all four sides of the iron until they are bright and free from all foreign material. Place a little flux on the point and immediately apply solder. The solder will, if the iron is clean, spread out over the point and form a thin film which adheres to the iron. You are now ready to solder the joint that you prepared. It will probably be found necessary to hold the wires in position with a pair of pliers, as illustrated in Figs. 7 and 8. This is in order to prevent them from moving out of place while the iron is applied and while the solder is cooling. By placing a little excess solder on the iron, and applying it to the point to be soldered, you will find that the solder will run on to the joint and will "sweat" into the wires, making a tight rigid joint. This sweating is absolutely necessary and it will be found that sometimes it is necessary to hold the iron at the joint for a few seconds until the sweating starts. The point being soldered in Fig. 7 is indicated by A.

Very often it is necessary to solder to lugs or projecting metallic points with which some instruments are equipped. In this case, the method is illustrated in Fig. 8. The wire, after it has been cleaned, is laid on top of the lug which has also been cleaned and the flux applied. A small quantity of solder is then picked up or placed on the heated iron and applied to the joint until it sweats in.

Three types of joints are illustrated in Fig. 6. A is what is known as a butt joint and is accomplished by placing the wires in position so that they are at right angles to each other as shown. Flux is applied and then, when the iron with a small amount of solder upon it is placed under the joint with the solder in contact with the wire, the solder will sweat in and form a perfect joint. This method of making a connection is sometimes not to be desired, as it is not as mechanically strong as it could be. To overcome this difficulty the method shown in B may be used. The wire to be soldered to another at right angles is turned into a loop at the end and the loop placed over the second wire. The loop is then closed up tightly with a pair of pliers and soldering is carried through in the same manner as in making the joint A.

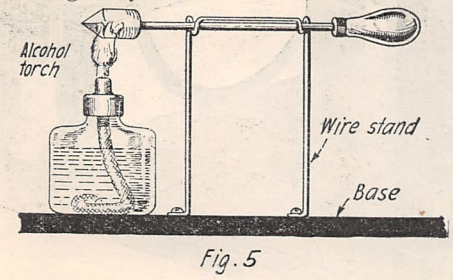


Fig. 5

An alcohol torch will produce sufficient heat for heating a small soldering iron, in absence of better means.

When soldering to lugs, such as shown at C, the wire is placed between the two prongs of the lug, flux applied and the soldering carried through. The prongs of the lug may then be bent down over the wire, making an electrically perfect and mechanically strong joint.

Another method of soldering wires that are not close to instruments or near the panel is illustrated in Fig. 9. The wires are cleaned, twisted together and flux applied to the point to be soldered. The twist is then placed in the flame of an alcohol torch as shown and solder applied. It will promptly sweat into the joint if the wires are clean and flux has been applied properly.

Before we leave the subject of soldering, let us emphasize and review several points. First—keep the iron clean and sufficiently hot to immediately melt solder. Second—have all wires perfectly clean and apply only a small amount of flux. Third—use only a good grade of solder, preferably that known as half and half. Fourth—never use anything but non-corrosive flux. Flux containing any acid that corrodes metals will cause joints to become weakened in time and will always result in trouble. Avoid acid content fluxes. Fifth—always apply heat to the joint long enough to enable the solder to sweat into place. Remember that the metals to be joined must be heated to a point above the melting point of solder before perfect union results. Sixth—if a plain soldering iron is used, which must be heated with a flame, always apply the flame to the base of the iron as shown in Fig. 5. Allowing the flame to play upon the tip of the iron will get that point dirty to the detriment of the work. Seventh—always have the wires in position by the time the iron becomes heated so that the process of soldering can be immediately carried through. Ninth—never try to solder with an iron that will not immediately melt wire solder. Attempting to do this will only result in a few crude looking slugs of solder being placed on the connection which will do no good. A smooth joint into which the solder has thoroughly sweated is the only efficient one.

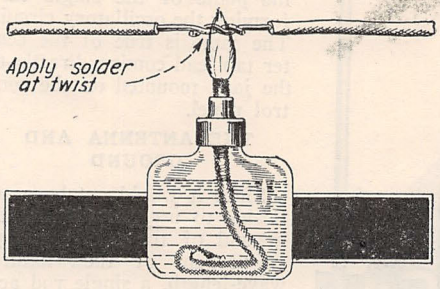


Fig. 9

Wires that are not close to instruments can be soldered together by heating the ends over an alcohol lamp and applying solder.

The question always arises in the mind of the amateur as to just what a soldering iron really is. It is not made of iron, although that term has been applied to the tool for so long that it has become accepted. Soldering irons are always made of copper, the reason being that copper holds its heat for a much longer time than iron. Furthermore, the copper can be heated more quickly and more thoroughly, resulting in an all around greater efficiency.

PLACEMENT OF INSTRUMENTS

Hand in hand with the proper soldering of connections goes the laying out of the various instruments comprising a complete receiving set. The first thing to watch is that the instruments be laid out so that the shortest possible leads can be run from one instrument to another and so that there will be as few crossings of wires as is possible. The most important short lead is that from the grid binding post of the detector tube to the grid condenser and leak. Preferably one end of each of the latter two instruments should be mounted directly on the grid binding post, although if it is necessary to do otherwise, the grid lead should be kept as short as possible. It should never be over two inches long. Attention to this one little point may save considerable worry over troubles that would otherwise develop later on.

Another point to watch is the placement of the various coils and transformers, if the set is of the multi-tube type. Never arrange the instruments so that the grid and plate leads run parallel for any appreciable distance. Such procedure would result in an interaction between the leads which would probably make the set noisy in operation. Also if it should happen that you are building a radio frequency amplifier, take care that the coils comprising the radio frequency transformers are placed far enough apart to prevent magnetic coupling between them. Six inches distance will usually be found sufficient and a larger space will not give any better results. In fact, it will be detrimental because of the longer leads required.

Regarding the audio frequency amplifying transformers, the writer would advise that builders always lay out the instruments so the coils of the transformers will be at right angles to each other. This is particularly true if the transformers are placed close to

(*Continued on page* 1746)

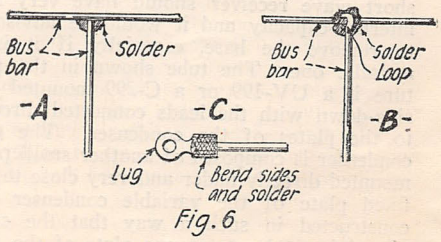


Fig. 6

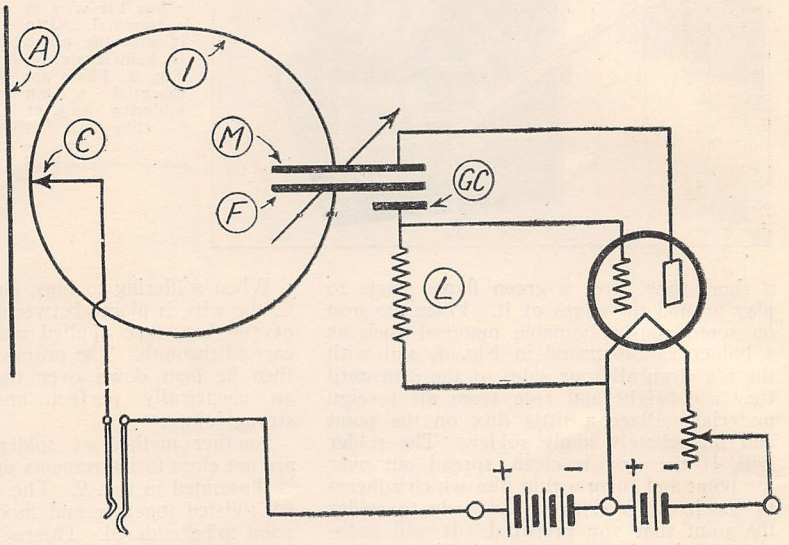
It is bad practice to solder two wires together in the manner shown at A. The B method is the best. C shows how a lug should be soldered to a wire.

How to Build an Ultra Short Wave Receiver

By THE STAFF OF RADIO NEWS

THE new wave bands given to the amateurs by the last Commission present very great possibilities for experimentation and research, and it is to encourage the keen experimenters to work along these lines that we publish herewith some data on very short wave apparatus.

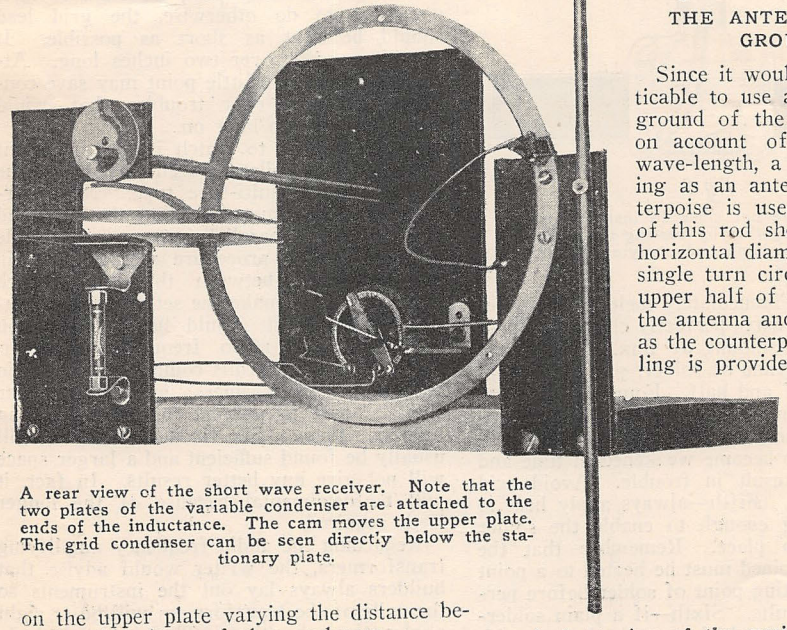
The receiver shown on our cover and in the various photographs, covers a range of about 4.5 to 5.5 meters. This wave band may seem extremely small as compared to that of most broadcast receivers, but it should be remembered that this one meter of variation represents a band of 15,000 kilocycles. In such a band of frequencies 1,500 broadcast stations could operate; that is, more than are actually in operation in the whole world.



The wiring diagram of the set. A is the antenna, C the sliding contact for controlling regeneration, I the inductance, M-F the variable condenser, GC the grid condenser and L the grid leak.

THE CIRCUIT

The circuit used in the receiver is the regular Hartley type. It is composed of a single turn with a center tap, which may be varied in order to produce regeneration or oscillations. If we consider this single turn as a coil, the grid and plate circuits are composed of one-half turn each. Shunted across this turn is a variable condenser with a minimum of dielectric in its field. It may not seem to be of very good mechanical construction, but it is simple and of good electrical design. In order to vary the capacity between the two plates forming this variable condenser a cam system mounted at the end of a long insulating rod presses on the upper plate varying the distance between the plates of the condenser.



A rear view of the short wave receiver. Note that the two plates of the variable condenser are attached to the ends of the inductance. The cam moves the upper plate. The grid condenser can be seen directly below the stationary plate.

THE DETECTOR

The detector tube used with this very short wave receiver should have very low internal capacity and it would be advisable to remove the base, especially if it is a metallic one. The tube shown in the picture is a UV-199 or a C-299 mounted upside-down with the leads connected directly to the plates of the condenser. The grid condenser is composed of another small plate mounted directly under and very close to the fixed plate of the variable condenser and constructed in such a way that the same piece of metal acts as one plate of the grid condenser and as the upper mounting of the grid leak. This construction provides extremely short leads, a feature which is very important in designing all short wave receivers. The filament leads are connected directly to the battery through a rheostat and should be wired so as to be at right angles with the plane of the single turn forming the oscillatory circuit. The same is true of the center tap lead coming directly to the jack mounted on the control panel.

THE ANTENNA AND GROUND

Since it would not be practicable to use an antenna and ground of the ordinary type on account of their natural wave-length, a single rod acting as an antenna and counterpoise is used. The center of this rod should be on the horizontal diameter line of the single turn circuit so that the upper half of the rod acts as the antenna and the lower one as the counterpoise. The coupling is provided by the proximity of the rod to the single turn circuit and may be varied by moving the rod away from the single turn to copper strip, but in the same plane. The rod should be one-half a wave-length long.

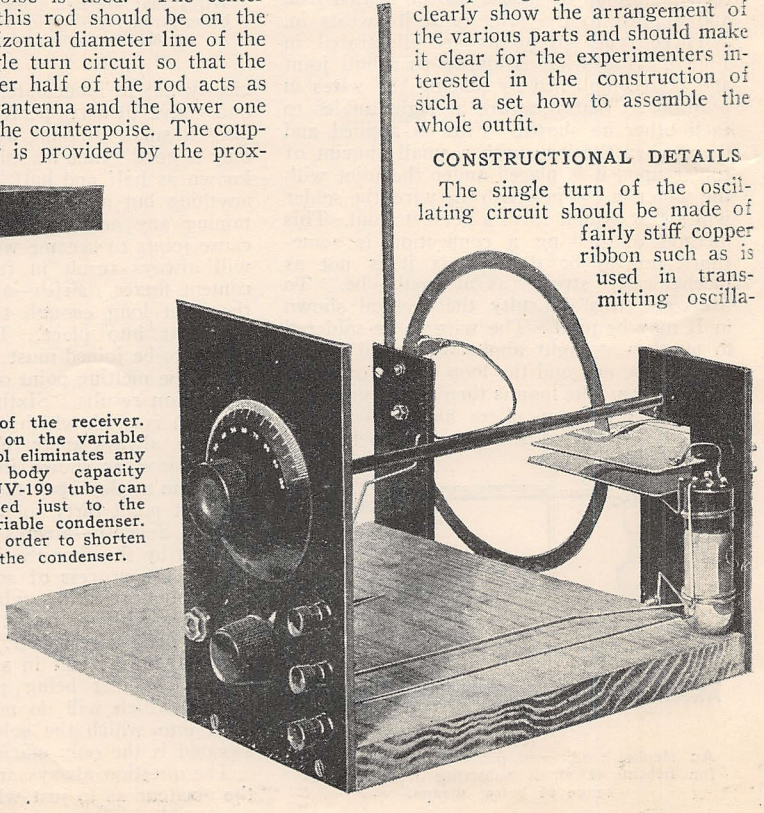
THE CONTROL PANEL

All the controls are mounted on a small panel, which is about 10 inches away from the circuit itself in order to avoid capacity effects when tuning. Since the adjustment of the variable condenser is extremely critical, it would be best to use some form of vernier dial providing a very slow motion of the shaft when the knob is turned. There are now on the market several types of vernier controls with high ratios which would be suitable for such a short wave receiver. On the panel are also mounted the filament rheostat, the telephone jack and the binding posts necessary for the connections.

The photographs and drawings clearly show the arrangement of the various parts and should make it clear for the experimenters interested in the construction of such a set how to assemble the whole outfit.

CONSTRUCTIONAL DETAILS

The single turn of the oscillating circuit should be made of fairly stiff copper ribbon such as is used in transmitting oscilla-



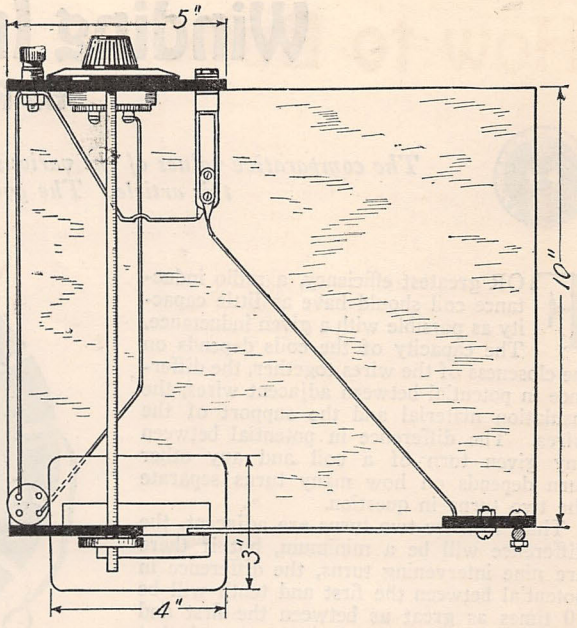
A front view of the receiver. The long shaft on the variable condenser control eliminates any possibility of body capacity effects. The UV-199 tube can be seen mounted just to the right of the variable condenser. It is inverted in order to shorten the leads to the condenser.

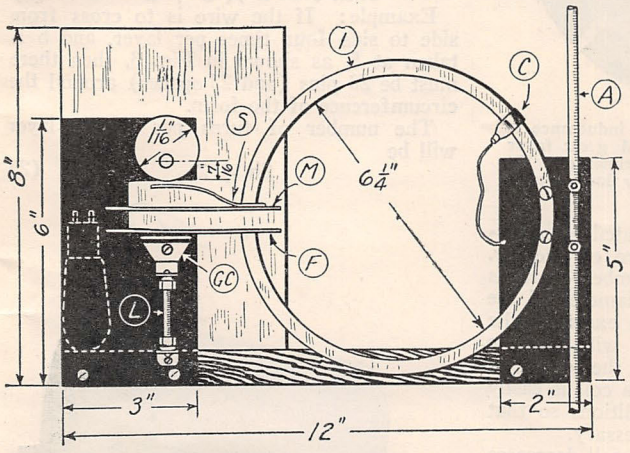
tion transformers. The two plates of the condenser, which are 3 by 4 inches, are made of springy copper 1-50-inch thick. The small plate used as one armature of the grid condenser is made of the same material and cut as shown in the drawing. The antenna and counterpoise rod may be a piece of small copper tubing or rod which should be stiff enough not to vibrate.

The cam and the rod used to vary the distance between the condenser plates may be of formica, hard rubber or other good insulating material. Three pieces of insulating material supporting the controls and the various parts of the circuit are screwed against the edge of a baseboard and should be of the highest grade of insulating material obtainable. As may be seen in one of the sketches, the small panel supporting the vacuum tube is used also as a guide for the condenser plates which are notched so as to fit against the edge. This prevents the plates from vibrating horizontally, which would change the capacity.

TRANSMITTING AT ULTRA SHORT WAVE-LENGTHS

The receiver described above may be used with the short wave transmitter described in the January and February issues of RADIO NEWS by Mr. Bruno for communication over short distances. The exact range of such apparatus is not yet accurately known, but it should prove very interesting to try in some good location how far signals sent by a short wave transmitter using 5 watts of power could be heard. Short wave transmitting apparatus is now being built in the RADIO NEWS Laboratories and will be described in the next issue of RADIO NEWS, but in the meantime, amateurs may use the Bruno transmitter for the purpose of experimenting.





The sketch above shows the manner in which the instruments and the variable condenser control are placed on the baseboard. The sketch to the left gives further constructional details. The figures are the same as those used as keys in the circuit diagram on the preceding page.

One of the most interesting experiments to try with short wave transmitting equipment is the reflection and concentration of the energy by means of reflectors such as those used in the beam system, and which was described in the May, 1924, issue of RADIO NEWS in an article on "Experimenting With a Two-meter Wave-length."

We should be pleased to hear from any of our readers trying out these types of transmitters and receivers, as we are now compiling all the data available on the efficiency, range, etc., of the very short wave-lengths.

Address all communications to the Technical Editor of this magazine.

The Future of Radio

By PROF. C. M. JANSKY*

TO any speaker desirous of selecting a good, safe subject I suggest that consideration be given to a topic on the future of something. No matter how wild your predictions, no one is likely to call you to account because, beyond the prediction of a few obvious certainties, it is impossible to check up on prophecies until the dim and distant future. I presume this is why newspapers like to speculate so profusely on the future of radio and a lot of other things. In view of the multiplicity of predictions one or two of them are bound to be true, and then someone can say, "I told you so." I noticed with much interest in the Sunday papers articles describing what would happen if we could see by radio anything, anywhere, at any time and others describing radio devices for solving cross word puzzles, putting out the cat, evading the 18th amendment and many other purposes.

IMMEDIATE PROBLEMS

All of these speculations are extremely interesting, amusing and perhaps valuable, but I must confess that I find too much to think and wonder about in the present accomplishments of radio and the coming events which are knocking at the door to spend a great deal of time on fantasy. The present and immediate problems of radio are so complex and far-reaching that they require the serious thought of all interested in its satisfactory future development.

These problems are so great that I must confine myself in this speech to the future of radio broadcasting, but in so doing I do not wish to leave the impression that the future of all other branches of the radio art are not extremely important. Any consideration of the present and future of radio broadcasting must consider its past. Here I wish to correct a popular misconception by stating that the radio art and radio broadcasting did not start in 1921 as many suppose. The history of radio goes back over sixty years, while radio broadcasting both by telegraph and telephone was done before the World War by a number of our mid-Western universities and colleges. One reason why our educational institutions do not many times receive more credit for the things they do is that they seem to abhor talking about them. I apparently do not run true to form in this respect, as it is generally known that the University of Minnesota started its broadcasting by telegraph in the fall of 1920, and by radio telephone in the spring of 1921. I call attention to the broadcasting done by our educational institutions because from the first they recognized that the greatest service of broadcasting is to our rural communities and to those who, because of their location, do not have continually available information, news, market reports upon which to do business and, in addition, high class education and entertainment material as is the case in our large centers of population. In the rapid development of over 500 broadcast stations this fundamental truth has at times been lost from sight. However, now we are in a position to open the door to a coming certainty, namely that radio broadcasting is becoming an integral part of the life of our rural communities and is rapidly taking away the economic and social handicap under which the rural dweller has lived in competition with his city brother. Because of the economic structure of this territory, the Northwest, it is a safe prediction that radio broadcasting will come to have an important bearing on its future prosperity and development.

A second development of tremendous importance is the simultaneous broadcasting to the entire United States of events of nation-wide interest and importance. Those of you who heard the election night programs from the Twin Cities and other stations received a glimpse of its possibilities. The broadcasting of the National Conventions and the Defense Day programs are other examples. To most of you the problem of giving such programs may seem simple, but I can readily prove to you that such is not the case. This country owes a debt of gratitude to the broadcast stations which have been willing to bear the great expense involved in producing these nation-wide programs.

DISCUSSION OF METHODS

Three possible methods of delivering nation-wide broadcasting are at present under intensive study. It is possible to connect up a number of stations by wire circuits and broadcast simultaneously from all of them. This is entirely practical and from an engineering standpoint entirely satisfactory, but the cost at present is almost prohibitive. If we are to continue nation-wide service by this method the cost must be reduced. The same problem is met in attempting to connect studios, orchestras, theatres, etc., with a transmitting set but a few miles away.

(*Continued on page* 1803)

*Professor of Electrical Engineering, University of Minnesota.

Winding Inductance Coils

By RAY E. KRUEGER

The comparative values of the various forms of tuning and inductance coils are dealt with in this article. The good and bad points of each are delineated.

FOR greatest efficiency, a radio inductance coil should have as little capacity as possible with a given inductance. The capacity of the coils depends on the closeness of the wires together, the difference in potential between adjacent wires, the insulation material and the support of the wires. The difference in potential between any given turn of a coil and any other turn depends on how many turns separate the two turns in question.

Thus, if these two turns are adjacent, the difference will be a minimum, but if there are nine intervening turns, the difference in potential between the first and tenth will be 10 times as great as between the first and the second. If the coil is so wound that the first and the tenth turns come in contact, the capacity at the points of contact will be 10 times as great as though the points, where the wires touch each other, were between adjacent turns.

The material composing the insulation and support of the coil is also important. About the best condition would be to have an air space around each wire, but it would not be possible to wind a coil in this way. This property of the insulating medium is called the "dielectric constant" or "specific

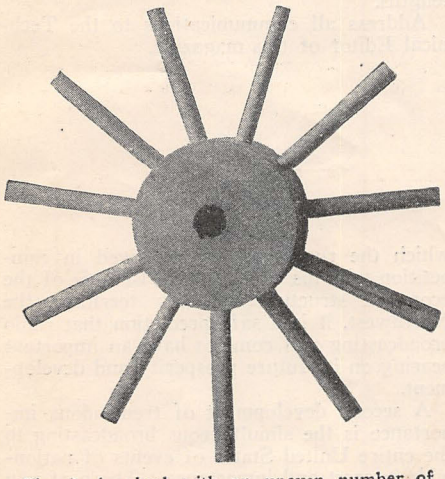


Fig. 7. A wheel with an uneven number of spokes is employed for a core upon which to wind the spider-web type of coil. The wheel may be removed.

inductive capacity" of the material. If we assume the dielectric constant of air to be 1, the corresponding constants of some materials are about as follows:

Air	1.0	Shellac	3.5
Manila paper	1.5	Silk	4.6
Paraffin	2.	Bakelite	5. to 7.5
Cotton	2.	Mica	6.4
Hard rubber	3.	Glass, dense flint	10.

From the above it will be noted that for a coil to have minimum capacity, a paper base or tube is better than bakelite, rubber or mica and that if it is to be waterproofed, paraffin is to be preferred to shellac. It is also better to use cotton insulated wire than silk insulated, and double cotton is better for this purpose than single cotton because the wires are separated by a greater thickness of the insulation.

FORMS OF COILS

The simplest inductance is a single layer of wire wound on a paper tube. (Fig. 1.)

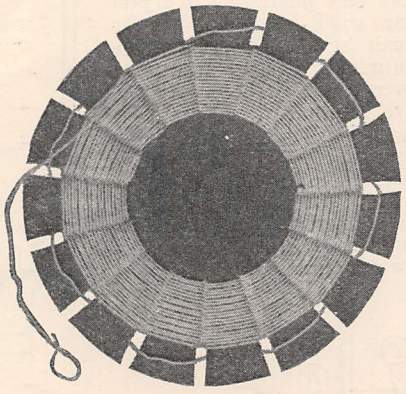


Fig. 6. The spider-web form of inductance is very well known and has found great favor among the more advanced experimenters. It has some points giving it very low losses.

The tube should first be saturated with paraffin to keep out the moisture of the air. The inductance of a given number of turns of wire will increase as the diameter of the tube is increased (to be more exact, as the square of the diameter), but will decrease as the length of the coil (not the length of the wire) is increased. Such a coil is easily made and altered to suit conditions so that no further description is necessary.

Because the inductance of a coil decreases as the length of the coil, various means are employed to shorten them and overcome this difficulty. The simplest means would be to wind layers on top of each other, but this would greatly increase the capacity, because each turn would be in contact with the turns above and below (as well as those at each side) and these turns would have much greater difference in potential because of the number of intervening turns. To partly overcome this increase in capacity, the form of multi-layer coil known as "bank wound," as shown in Fig. 2, was developed. Such coils are, however, difficult to wind and are usually not as efficient as some of the forms to be described below.

HONEYCOMB COILS

An efficient form of inductance is the honeycomb coil. In this form, the adjacent turns are separated from each other, but each turn comes in contact at the points of crossing with each other turn of the layers above and below.

This would not be so objectionable if there were only a few turns per layer, but as usually wound, there are about 26 turns per layer. An improvement, especially for coils of less than 100 turns, is to decrease the turns per layer. This can be done according to the formula given herewith. The diagram, Fig. 3, represents the circumference of the winding form usually employed, the wire being wound around pins, as shown.

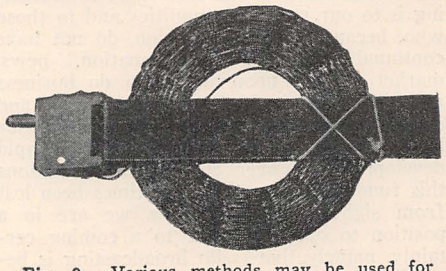


Fig. 9. Various methods may be used for mounting the spider-web type of coil when it is to be used in a circuit of variable coupling. One very good method is illustrated above.

a = the number of times the wire crosses from one row of pins to the other row in each layer; a should be an even number of times, i. e., 2, 4, 6, 8, 10, etc.,

b = the number of pin spaces between loops, and

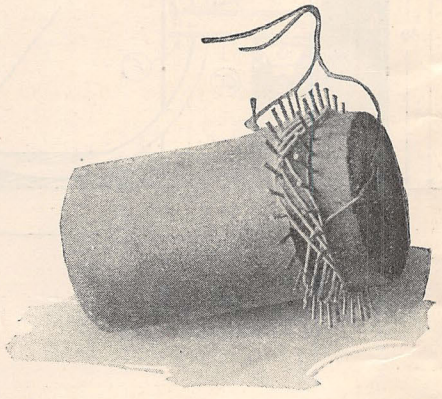
t = the total number of pins in the circumference.

Then $t = a \times b + a - 1$ (1)

Example: If the wire is to cross from side to side four times per layer, and b is taken at 5, as shown in Fig. 3, then there must be 23 pins (and 23 spaces) around the circumference of the form.

The number of turns per double layer will be

$$2b + 2 \quad (2)$$



A good method of winding honeycomb coils is shown above. After the form is made as shown in Fig. 4 the pins are suported on a block.

or, in the above example there will be 12 turns per double layer.

In order that wires will not cross each other at too acute an angle, the rows of pins (i. e., the length of the coil) should not be less than given by the equation.

$$c = \frac{bd}{t} \quad (3)$$

where c is the distance between rows of pins and d the diameter of the form.

It is thus desirable to have the number of turns per layer as small as possible and at the same time to keep c as small as possible, consistent with the equation (3).

MAKING THE COIL

Following are suggestions for making the form and winding this kind of coil:

Obtain a smooth wooden cylinder, maple is best, about 1¾ inches to 2 inches in diameter and five or six inches long.

Wrap a sheet of letter size paper around the cylinder and very carefully mark the exact circumference on the edge of the sheet. Then lay the paper flat on the table and divide this circumference into as many equal parts as there are to be pins and spaces, as determined in formula (1).

An easy way to do this is indicated in the diagram in Fig. 4. Lay a ruler on the sheet, as shown, at any angle with the edge of the paper and mark off as many quarter inches from one end of the circumference (as at a) as there are to be pins, to points c. Con-

nect c with the end of the circumference b and then draw lines parallel to cb which will divide ab into as many equal parts as there are to be pins. Then again wrap the paper around the cylinder and very carefully mark each point. The care with which the pins are located will have a great deal to do with the neatness of the resulting coil.

For pins, used phonograph needles will be found very satisfactory. Small brads will also do, but they are not as smooth as the phonograph needles. Ordinary pins are hardly stiff enough and are too long, except for large coils. The pins should be driven in radially and until they hold firmly. Then wind a layer of string (small cotton or very heavy thread is best) between the two rows of pins, like the hose on a reel, and fasten the two ends by tacks driven near the ends of the cylinder. Then tightly wind a strip of heavy tough paper which has been cut just wide enough to go between the pins, but not to burr up at the pins.

This may go around two or three times and be held in place by small drops of glue. The form is now ready for the wire. No. 26 or No. 24 cotton covered wire will be very satisfactory. Fig. 5 shows winding form with several turns wound on.

THE WINDING PROCESS

Hold the form in the left hand and the spool of wire in the right and very carefully wind the first turn, counting the spaces between the loops so that b will be the number determined upon. If the first turn is put on correctly, the other turns will follow easily, always coming just one space from the preceding turn.

Keep track of the number of turns from the number of double layers and when the required number has been wound, fasten the end of the wire around one of the tacks, holding the string. Then carefully apply collodion (the bulk variety, not containing castor oil, is the best and should be rather thin) to the edges of the coil and also at intervals around the outside of the coil and allow it to harden. The paper used under the coil should not be paraffined, because the collodion will dissolve the paraffin and then not harden. After the collodion has hardened, carefully pull out the pins, using a small pair of pliers, and then pull the string out from under the base of the coil. The space occupied by the string will permit the coil to be easily removed from the cylinder. It is well to wind a few more turns on the coil than required and then remove the surplus turns, one at a time, as found necessary after testing the coil in the set.

SPIDER-WEB COILS

Spider-web coils are at least as efficient as honeycomb coils and if the number of turns required can be wound within the available diameter, they are usually preferred. They are much easier to make than honeycomb coils, but for greatest efficiency, care should be taken in selecting the material of the form, so as to get one which has the necessary strength and stiffness, but with as low a "dielectric constant" as possible.

The material may be cardboard soaked in paraffin. The base of the slots is usually a circle 1½ inches to 2 inches in diameter and the length of the slots and outside diameter

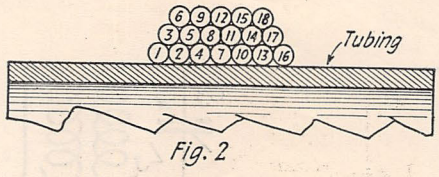


Fig. 2

In making bank wound coils a very definite form must be followed. This is illustrated above. The number in the center of the wire is the turn number.

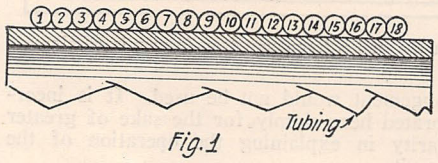


Fig. 1

The method usually followed in making a single layer coil is extremely simple. The turn sequence is shown above for comparison with Fig. 2.

made sufficient for the required number of turns of wire. An easy way to determine the outside diameter of the insulated wire is to count the number of turns on the spool in the space of one inch; thus, if there are 50, the wire is 1/50 of an inch in diameter. If 80 turns are to be wound, the slots must be 80/50 or about 1⅝ inches long, plus enough extra to hold them well. The form must have an odd number of slots, as in Fig. 6; the wire is not cemented in place, but holds because of the shape of the form.

FLAT COILS OF REINARTZ TYPE

The most efficient and at the same time easiest wound coils we know of are the flat self-supported coils similar to the well known Reinartz coils. The form may be a wooden cylinder, as shown in Fig. 7, say 2 inches in diameter and any convenient length, about 2 or 3 inches.

In a circumferential line around the center of the cylindrical face, lay off an odd number of spaces, about 11 or 13. At each point, bore a hole in the diameter of such wooden doweling as is available, say ⅛ or 3/16 inch. Nails of proper size may be used. These holes should be radial and carefully centered at the 11 or 13 points and of such size that the wooden pins or nails will fit snugly. Cut 11 or 13 pins of the wooden stock, each about 4 inches long, and place one into each hole. Then wind four turns of string on the form, winding *over two* and *under two* regularly around the pins.

Then wind the wire, say No. 24 D.C.C., on top of the string and in the same manner; *i. e.,* over two pins, and then across and under two pins, then across and over two pins, etc. After the required number of turns has been wound, fasten the outside end, and then put collodion along the points where the wires cross each other, on both sides, also all around the first and last four or five turns. When the collodion is almost hard, carefully remove the pins and when fully hard, pull out the string and remove the coil.

This form of coil is very efficient because there are only four turns per layer with the capacity thus low at the points where the wires touch each other; because it is self-supporting and does not require a base, and because it is short as compared with its diameter.

MODIFIED FLAT COIL

Where the required number of turns is not great, say up to 30 or 35 on a 2-inch center, a still more efficient coil can be wound by winding over one peg and under one, as in Fig. 8, instead of over two and under two. Such a coil is otherwise made in exactly the same way as the flat coil previously described.

With this coil each turn is in close contact with only the turn above and the turn below at the points of crossing and the coil has, therefore, a smaller capacity than the two over and two under type. Not less than 13 pegs on a 2-inch cylinder should be used with this type in order to avoid making the angle of crossing of the wires too acute.

Fig. 9 shows a method of mounting the coils.

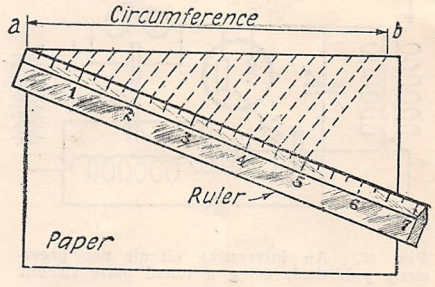


Fig. 4. The method usually employed by amateurs for laying out the coil form for honeycomb coils is given above. A ruler and paper are the only requisites.

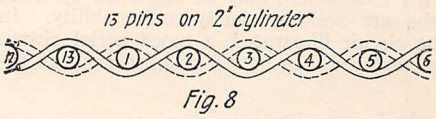


Fig. 8

The alternate pin method of winding a spider-web coil of conventional design is given above.

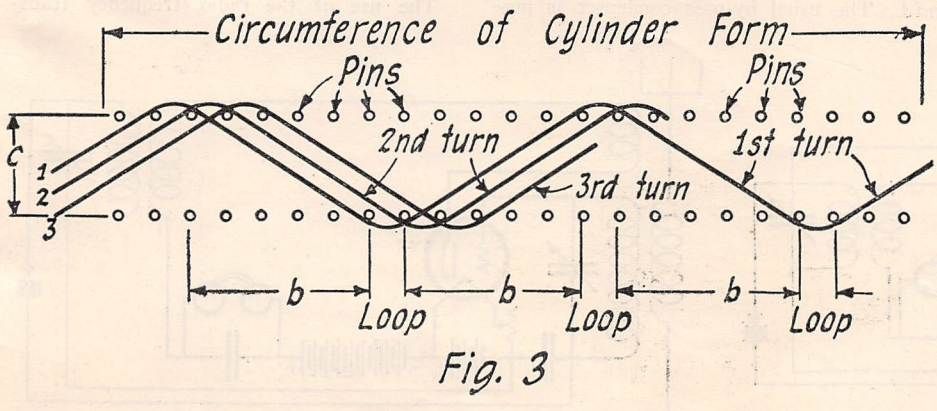


Fig. 3

The honeycomb form of coil is another one which has come into great favor with the experimenters. The method of winding the wire on the pins is given above. The pins are placed around the periphery of a circle.

ADVANTAGE OF GOOD COILS

It may well be asked whether there is any real advantage in these theoretically better coils, wound on the form shown in Fig. 7 and using the method shown in Fig. 8. The writer can say definitely that such coils have secured results during bad radio weather, when ordinary honeycomb coils would not produce an audible signal. For a given range in condenser capacity, they will show a greater range in wave-length or frequency and will produce louder and clearer signals generally than either the honeycomb or the ordinary coil wound on a tube.

Reflex Radio Receivers in Theory and Practice

By JOHN SCOTT-TAGGART, F. Inst. P., A.M.I.E.E.

Part V

Some excellent single tube reflex circuits, employing crystal detectors as rectifiers, are described in this article. Regeneration is incorporated in a few of them.

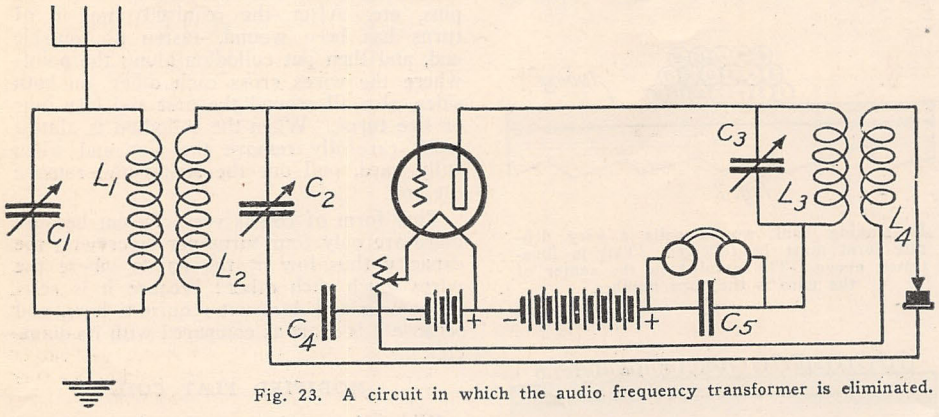


Fig. 23. A circuit in which the audio frequency transformer is eliminated.

GREAT improvement can be made in the stability of a reflex set if a condenser is substituted for the audio frequency transformer, which feeds back the rectified currents into the tube, as shown in Fig. 23. The chief advantage of this substitution is the elimination of much of this undesirable feed-back usually in attendance when the transformer is employed, due to the distributed capacities of the instrument.

Of course. the absence of the transformer will be noted in signal strength. The loss of voltage step-up to the grid of the tube will leave the signals appreciably weaker, but at the same time a great deal clearer. This idea should only be employed by those who are seeking clarity and stability. In the circuit illustrated, a tuned aerial circuit is employed. In actual practice such an arrangement would not be used. It is incorporated here simply for the sake of greater clarity in explaining the operation of the circuit.

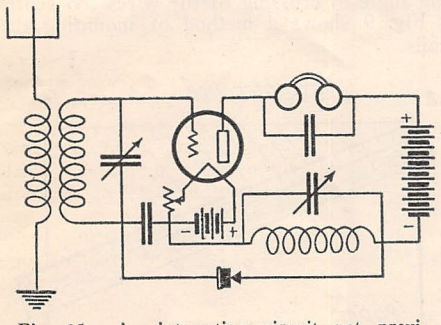


Fig. 25. An interesting circuit not previously published, using a tuned plate circuit.

The radio frequency currents are communicated to the grid circuit and passed, amplified, to the circuit L3, C3 which is tuned to the incoming wave. Then the radio frequency currents are passed to the crystal detector in which they are rectified. From the crystal the signals pass to the condenser which takes the place usually occupied by the audio frequency transformer in the grid circuit of the tube. Here they actuate the condenser so as to change the potentials of the grid in accordance with the audio frequency. The signals are again amplified as they pass through the tube and go on to the receivers where the audible sound is produced. The capacity of the condenser in the grid circuit may be of approximately .0003 mfd. The usual by-pass condenser is provided to give the radio frequency currents an easy path by the phones.

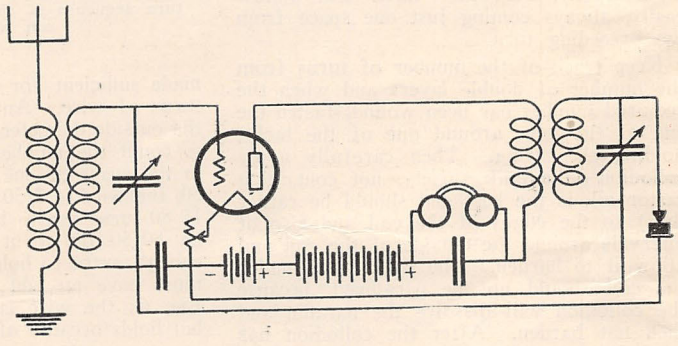


Fig. 24. A modification of the circuit shown in Fig. 23 in which the crystal detector circuit is tuned and coupled to the plate circuit of the tube, which is aperiodic.

An adaptation of the Fig. 23 circuit is shown in Fig. 24. The only change made is that the primary portion of the crystal circuit is tuned, instead of the plate circuit of the tube, as in the previous arrangement. This connection will, of course, remove almost all tendency of the tube to oscillate and at the same time prevent any regeneration which may be undesirable, since the addition in signal strength gained through a small amount of feed-back greatly increases the sensitivity of the set.

Several experimenters will, no doubt, wonder just what situation confronts the connection of the detector across the condenser and just how a difference of potential is gained so that the grid may function at audio frequency. In practice it usually happens that there is sufficient leakage across the condenser C4 to act as a high value resistance, thus giving the necessary difference in potential. It will at once be suggested that a separate resistance be employed in parallel to the condenser so that the exact and proper value could be employed, thus operating the set at the highest possible efficiency.

This arrangement was tried, but proved more or less superfluous, since little, if any, advantage was obtained through it. Grid leaks of a number of different values were used, but with no additional signal strength.

Some may question the absence of a grid leak and the question of biasing the grid of the tube with an individual battery. A close examination of the circuit will show that there is a clear path existent from the grid to the negative side of the "A" battery through the crystal circuit.

The use of the radio frequency trans-

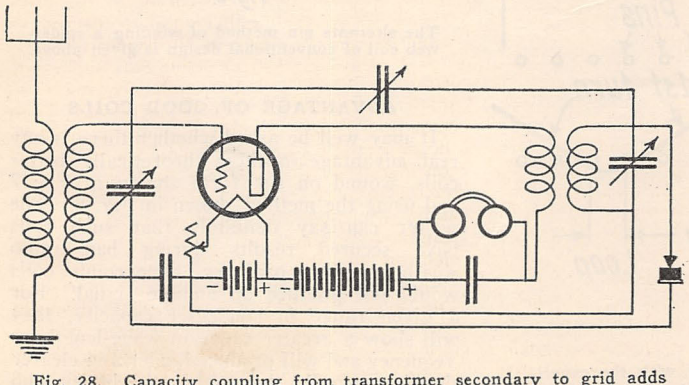


Fig. 28. Capacity coupling from transformer secondary to grid adds regeneration to this circuit. The crystal detector circuit is tuned.

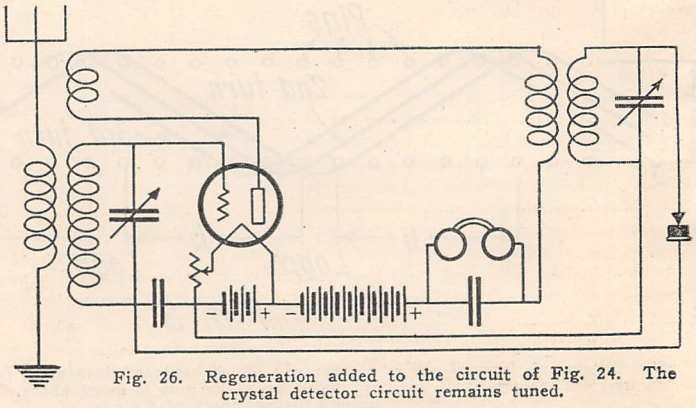


Fig. 26. Regeneration added to the circuit of Fig. 24. The crystal detector circuit remains tuned.

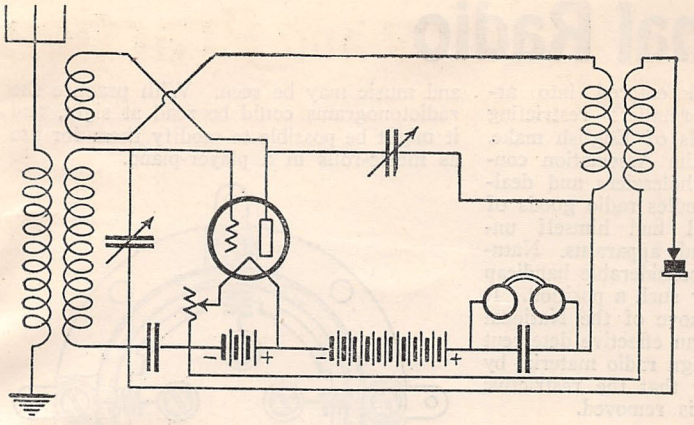


Fig. 29. Another method of introducing regeneration. The crystal detector circuit is untuned.

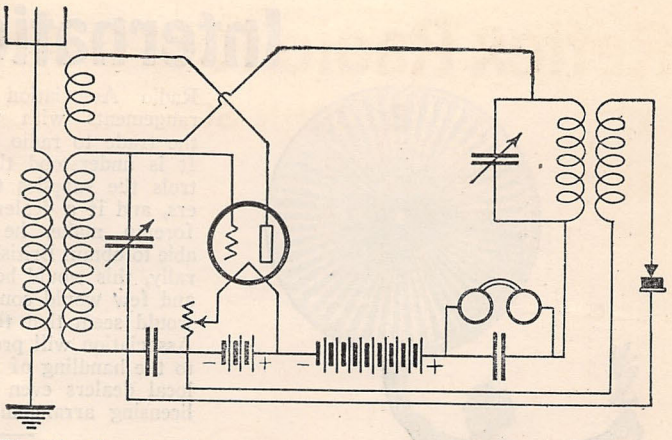


Fig. 30. In this circuit the feed-back coil does not influence the tuning of the circuit.

former in these circuits should be fairly obvious. If it were not for its interposition between the plate and the crystal detector circuit, the "B" battery voltage would be communicated to the grid of the tube, thus placing such a high bias on the grid that it would be impossible to operate the set. The use of the radio frequency transformer separates the two circuits.

In Fig. 26 we have another adaptation of the original circuit shown in Fig. 24. The addition of the tickler coil is shown in series with the primary of the radio frequency transformer. It will be necessary to make the coil as small as possible, consistent with the proper amount of regeneration to give the set the necessary sensitivity. In the possibility of making the coil too large lies the danger of causing the tube to fall into oscillation. There will be some capacity tuning in any event, and, coupled with the primary circuit of the tube, there may be enough inductance and distributed capacity to bring the plate circuit almost to resonance with the grid, which is a condition much to be shunned.

Another adaptation of the same arrangement is shown in Fig. 27. In this instance the tickler is included in the secondary circuit of the transformer. Usually, the transformer will be purchased to cover a certain definite band of wave-lengths. The inclusion of the tickler in the circuit will alter this band to some extent, but not enough to cause a material decrease in signal strength or sensitivity. With the tickler in this position there is less liability of tube oscillation than in the previous case.

A third method for producing regeneration through capacitive coupling is illustrated in Fig. 28. The secondary of the radio frequency transformer is coupled to the primary circuit of the tube through the agency of a variable condenser. The control of this circuit may be found somewhat more erratic than those described previously, but the idea is a good one for the use of the experimenter.

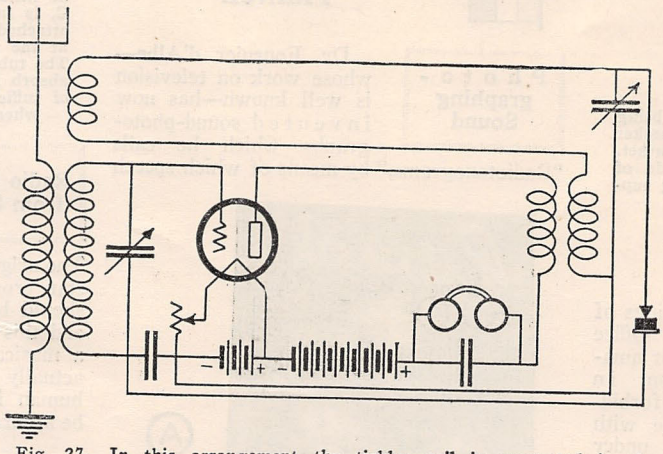


Fig. 27. In this arrangement the tickler coil is connected in the secondary circuit.

The condenser used in the feed-back circuit should be of the small vernier type. Its actual capacity will depend, of course, upon the band of wave-lengths to be covered by the set. The writer is not greatly in favor of the particular method of regeneration, since the condenser must be rather critical in its adjustment, thus adding another and seemingly unnecessary control.

By employing this idea in conjunction with a tickler feed-back circuit in which the tickler is used in reverse relation —the Superdyne principle—a much better control of the tube's actions may be obtained. The Superdyne principle has found a great deal of favor since its introduction to the public on account of the great efficiency at which radio frequency amplification may be worked. This is an entirely new adaptation of the idea, with a few changes in the circuit (those depicted in Fig. 30). With these changes, almost complete control may be had with a corresponding rise in the over-all efficiency of the set.

In Fig. 30 there is the regulation tuned plate circuit used in conjunction with the tickler feed-back. This is possibly the best of the circuits using regeneration and control at the same time. As in all other circuits described in this series, a fixed condenser is used instead of the audio frequency transformer to feed back the rectified currents to the tube the second time they pass through it, and thus eliminating the distortion common to audio frequency transformers.

Listening to the Electron

By GUY BARTLETT

SCIENTISTS have recently succeeded in listening to the electron.

The vacuum tube amplifier in which the amplification is carried to a hundred-thousand fold, and with which a million fold can be reached, makes this possible. The sound produced by the electrons is caused by bombardment of the plate by electrons, released from the hot filament. It is these electrons, the smallest known particles of matter, which carry the current and which make the operation of the tube possible. So, the noise is a fundamental property of electron emission, a characteristic of the electron.

These facts were brought out in a paper read by Dr. A. W. Hull, of the research laboratory of the General Electric Company, Schenectady, N. Y., at the annual meeting of the American Physical Society at Ann Arbor, Mich., describing experiments conducted by Dr. N. H. Williams, of the University of Michigan, and himself, in which they listened to electrons.

While users of vacuum tubes are not interested in listening to the noise, it is a phenomenon of scientific interest, and in the research laboratory of the General Electric Company at Schenectady a careful study has been made of it. The work is being continued by Dr. Williams at the University of Michigan. It has been found that the noise is proportional to the number of electrons which fly across the tube each second.

The noise, due to the electrical oscillation which is set up by the impacts of the individual electrons on the plate, is known as the Schrot effect and was predicted on theoretical grounds by Dr. Schottky, of Berlin. The energy of each blow is extremely minute, but, like rain drops, the energies of the many individual impacts add and their sum becomes very large.

To listen to the sound of the electron is a feat in itself which gives an added charm to the vacuum tube. Listening to the electron, however, is but incidental to the studies which have been made by the scientists.

Not long ago the electron was unknown. First scientists had the molecule, itself so small that man has not yet seen it. Then came the atom, the minute integral part of the molecule. For a long time the atom was considered as the ultimate particle of matter. But each element presents a different atom. Science was not content to rest. It sought to connect all phenomena, and the electron was the result.

Scientists now believe that all matter is composed of electrons and that different substances result from the different properties possessed by the atoms according to the number and arrangement of the electrons they contain.

International Radio

That the aesthetic side of radio is not being neglected is shown by this artistic loud speaker recently placed upon the English market. The diaphragm of the speaker is made of pleated parchment, the phone unit being supported close behind it.

ENGLAND

English Amateurs Aroused

The stringent rulings of the British Post Office Department against amateur transmission, in which it has been forbidden to all amateurs to communicate with amateurs of other countries except under special license, has attracted the attention of members of Parliament. One member directly questioned the Postmaster General as to whether the latter realized the discontent that the ruling had created in radio circles.

The Postmaster General replied that every effort was being made to encourage amateur experimentation and transmission and that arrangements were being made with many radio societies to increase this scope by the issuance of further experimental licenses. The radio press of England hails this statement as a decided overture for amicable settlement of the difficulty.

One of the strongest arguments against the ruling has been the extraordinary success of amateur 2OD (E. J. Simmonds) in getting in touch with New Zealand. As the *London Times* points out, no amateur could state beforehand that he was going to try to work with such distant stations, and, therefore, it was merely a matter of chance that such records could be established.

As the work may well prove of primary importance in DX work it is expected to be one of the broadsides fired at the Postal Department and may even do away with the necessity of using the campaign fund advanced by *Modern Wireless* and *Wireless Weekly* to fight the prohibitory regulations.

Import Restrictions Dropped

Although import restrictions were dropped at the beginning of this year, British manufacturers have formed a National Radio Association and entered into arrangements with the retailers restricting the trade to radio goods of English make. It is understood that the Association controls the supplies to wholesalers and dealers, and if a dealer handles radio goods of foreign make, he will find himself unable to obtain British made apparatus. Naturally, this would be a considerable handicap and few would consider such a position. It would seem that the move of the National Association will prove an effective deterrent to the handling of foreign radio material by local dealers even now that the restrictive licensing arrangement is removed.

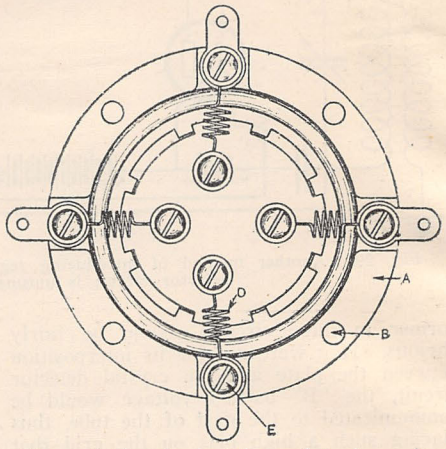
G. B. S. Broadcasts

We believe that in the early days of radio broadcasting Mr. George Bernard Shaw was somewhat hostile to this innovation, and issued very strict instructions that his plays were not to be broadcast. If this was indeed the case Mr. Shaw, with his characteristic good sense, has altered his views, as recently he broadcast his own play, "O'Flaherty V.C.," from a London station.

FRANCE

Photographing Sound

Dr. Fournier d'Albe—whose work on television is well known—has now invented sound-photographs which he calls "Radiotonograms," by means of which speech and music may be seen. With practice the radiotonograms could be read at sight, and it might be possible to modify them for use as music-rolls in a player-piano.



The anti-microphonic tube socket shown in the accompanying sketch is suspended by springs from its base, reducing to a minimum internal tube vibrations. The base, A, is provided with holes, B, for mounting the socket to the base-board, and C, is the holder in which the tube is mounted. The holder, C, is fastened by four springs, D, which are attached at one end to the tube sockets and at the other to the base by the screws, E. The tube is thus supported on springs, which absorb mechanical shocks. The springs are of sufficient strength to withstand any strain when a tube is inserted or removed.

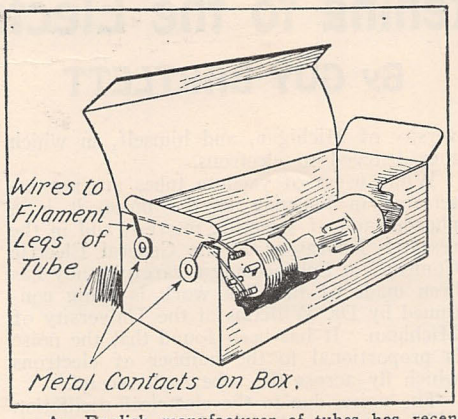
Radio Time from Stars

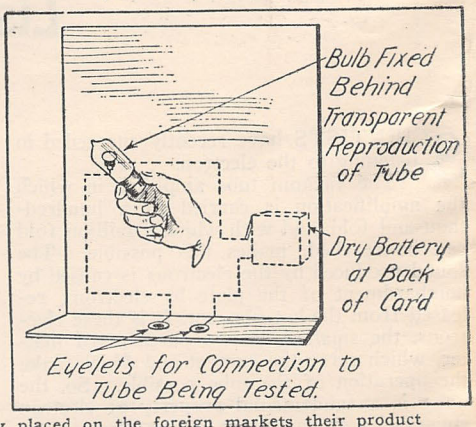
Making the stars work is the latest idea of a French scientist and it will be soon tested at the Eiffel Tower in Paris. The originator suggests that as the light of a star crosses the eyepiece of a telescope it should be made to operate a selenium cell, and this in turn could be made to broadcast a musical note, so that the listeners would actually "hear" the star. Broadcast without human intervention, this time signal would be accurate to within a millionth of a second.

New Mountain-Top Broadcast Station

The first radio station located on a high mountain was recently opened on top of the Pic du Midi, in the Pyrenees. The station is 9,330 feet above sea-level. The station will broadcast mainly weather reports for the farmers in the South of France and it is

(*Continued on page* 1805)





An English manufacturer of tubes has recently placed on the foreign markets their product packed in a carton that permits the tube to be tested for the customer without unsealing the box. As each tube is packed in cotton cloth, a wire is wound around each of the two filament legs and connected to two metal eyelets "A" inserted in one end of the carton, as shown in the illustration. When the packing is completed, the box is sealed. The method of testing the tubes is ingenious. The retail dealer is supplied with a showcard (similar to the one illustrated) which is provided with a flashlight bulb and battery. The eyelets "B" on the edge at the bottom of the card are connected to this bulb and battery. To test the tube in the sealed carton, the eyelets of the box are placed over those on the showcard, and if the filament of the tube is perfect, the flashlight bulb will light up the transparency. In this way the customer is assured that the filament of his new tube is perfect.

The First Annual Radio Set Directory

By HUGO GERNSBACK

A complete list of radio sets of American manufacture, with sufficient data on each for the prospective buyer to make an intelligent selection.

RADIO NEWS takes great pleasure in presenting, this month, its first annual Radio Set Directory. We believe that this is the greatest Directory of American Radio Sets ever presented.

The question, "What set shall I buy?" is answered in the pages that follow. As we stated editorially some time ago, American radio sets have now been improved to such an extent that it may well and truly be said that set manufacturing in this country has now reached a point where the public is no longer offered experiments or sets of doubtful quality. Nearly all of the sets now made are excellent and nearly all may be relied upon to perform the work that is expected of them.

When it comes to a choice, buying a radio set is much like buying a car. A Ford will take you practically the same distance as a Rolls Royce. In other words, the more you pay for a set, the more refinements and luxury you get. Then, of course, there is physical appearance that has a lot to do with the choice. Buying a good radio outfit in a very poor cabinet may do for some people, but the majority today seem to prefer a set that matches their home surroundings—a radio which they can be proud to show to their friends.

As a guide to those interested in securing a radio outfit, we desire to give the following information, which may be used to help decide in the selection of a set. For short distances, not more than 15 miles average radius, a crystal set will do. Such sets must be used with headphones. From 1 to 6 headphones can be connected with good results. No loud speaker results can be had with crystal sets.

Single tube sets, if of the regenerative variety, are good for a radius of from 500 to 1,000 miles. From 1 to 6 head receivers can be used with such a set. They cannot be used, as a rule, with loud speakers.

A good one-tube set is ordinarily as sensitive as a 4- or 5-tube set; it will bring in good distance on the head receiver. In other words, it has the sensitivity, but not the power of the multi-tube sets. Aerial and ground are required with a single tube set, the same as with a crystal outfit.

Coming to the multi-tube sets, it should be understood that, as a rule, it takes a 3-tube set to operate a loud speaker. While certain 2-tube sets will bring in local stations with fair volume, they cannot be relied upon to do so under all circumstances, with but few exceptions. It should be recognized that the multi-tube set does not necessarily bring in greater distances than the single tube sets. What it does, however, is to bring in distant stations much more loudly, more clearly and better. The more tubes that are used, the louder and more satisfactory will the broadcast reception be. However, well designed tuned radio frequency sets and those of the Super-Heterodyne class will, in addition to increased volume, give greater distances than will the single tube sets.

Up to and including the 3-tube outfit, speaking generally, it is necessary to use either an outdoor or a good indoor aerial. Loop aerial sets, generally, require at least 4 or more tubes.

There are, of course, certain exceptions to all this, but the above statements have been made merely to guide the average buyer when buying a radio set.

In the columns below there appear the photographs, together with short descriptions, of practically every radio set on the American market today. The outstanding features, including Number of Controls, Type of Circuit, and the Number of Tubes are given in the text alongside of the photographs. Unless otherwise noted, the price quoted by the manufacturer covers only the set as it stands, without tubes, batteries, loud speaker, telephone receivers, antenna and ground equipment.

The sets described here are the result of a general call to all radio set manufacturers. There is a possibility that not all of them responded, and we shall, in all probability, publish the remaining sets in our next issue, if this should be necessary.

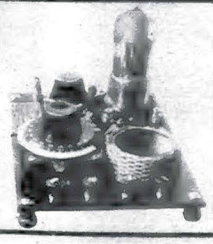
It is a matter of great pride that we are privileged to present to our readers practically every first class set made in this country today. It is a most remarkable array, and we believe that the technique, workmanship and performance of the sets pictured here cannot fail to astonish even those who know something about this great and growing radio industry of ours.

It is to the everlasting credit of the radio industry that in the short space of two years it has been able to muster such a tremendous output of really first class products. It took the phonograph and automobile industries fifteen years to cover the same ground.

We repeat, from an editorial published some time ago, that the best time to buy a radio outfit is NOW. All the latest models are on the market this very minute. Do not let the argument that radio outfits will be greatly improved in the future deter you from buying a set. Radio outfits WILL be improved in the future. So will automobiles, houses, shoes and everything else. You know that five years from now the automobile will be vastly improved over your 1925 model. That does not deter you from enjoying this year's car. The same logic must be used when contemplating the purchase of a radio set.

The time to buy a radio set is NOW.

Sets Are All Listed Alphabetically by Name of Manufacturer



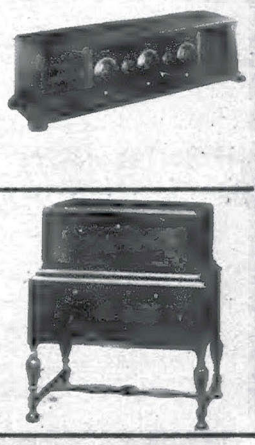
TRADE NAME: Babydyne.
TYPE: Regenerative.
TUBES: One.
BATTERIES: "A" and "B" required.
CONTROLS: One.
AERIAL: Outside.
PRICE: $10 without accessories.
MANUFACTURER'S NAME: A. & T. Radio Co.

TRADE NAME: "A-C Dayton XL-5."
MODEL: Console.
TYPE: Tuned radio frequency with control for balancing.
TUBES: Five.
BATTERIES: Storage battery or dry cells.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $250.00 with built-in loud speaker.
MANUFACTURER'S NAME: A-C Electrical Mfg. Co.

TRADE NAME: "A-C Dayton XL-5."
MODEL: Standard.
TYPE: Tuned radio frequency with control for balancing.
TUBES: Five.
BATTERIES: Storage battery or dry cells.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $115.00 without accessories.
MANUFACTURER'S NAME: A-C Electrical Mfg. Co.

TRADE NAME: Adler-Royal Neutrodyne.
MODEL: Table type No. 201A.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "B" batteries in cabinet.
CONTROLS: Three
AERIAL: Indoor, outdoor.
PRICE: $160 without accessories; $215 with accessories.
MANUFACTURER'S NAME: Adler Mfg. Co.

TRADE NAME: Adler-Royal Neutrodyne.
MODEL: Table type No. 199.
TYPE: Neutrodyne.
TUBES: Five UV-199.
BATTERIES: Dry cells contained in cabinet.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $165 without accessories; $205 with accessories.
MANUFACTURER'S NAME: Adler Mfg. Co.



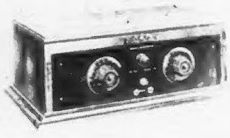
TRADE NAME: Adler-Royal Neutrodyne.
MODEL: Floor type No. 1 Elizabethan.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: Contained in cabinet.
AERIAL: Indoor, outdoor.
CONTROLS: Three.
PRICE: $350 including loud speaker.
MANUFACTURER'S NAME: Adler Mfg. Co.

TRADE NAME: "Ambler-Holman Receiver."
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "B" and "C"; batteries may be contained in cabinet.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: Ambler-Holman Co.

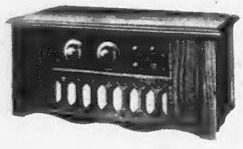
TRADE NAME: Etherphone.
MODEL: RX-3.
TYPE: Reflex circuit.
TUBES: Two.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $45.00 without accessories.
MANUFACTURER'S NAME: American Etherphone Corporation.

TRADE NAME: Etherphone.
MODEL: TR-5.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: American Etherphone Corporation.

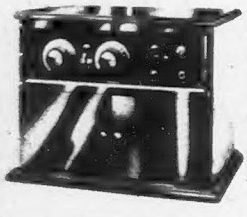
TRADE NAME: Etherphone.
MODEL: RX-4.
TYPE: Reflex.
TUBES: Two.
BATTERIES: None furnished, but compartments provided for in set.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: American Etherphone Corporation.



TRADE NAME: "Amrad."
MODEL: Neutrodyne
TYPE: One tuned radio, detector and three audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $85.00.
MANUFACTURER'S NAME: American Radio and Research Corporation.



TRADE NAME: "Amrad."
MODEL: Cabinette; built-in loud speaker.
TYPE: One radio, detector and two audio.
TUBES: Four.
BATTERIES: "A" and "B" needed.
CONTROLS: Two.
PRICE: $180.00 without accessories.
AERIAL: Outside or inside.
MANUFACTURER'S NAME: American Radio and Research Corporation.



TRADE NAME: "Amrad."
MODEL: Inductrole.
TYPE: One radio, detector and two audio.
TUBES: Four.
BATTERIES: "A" and "B" needed.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: American Radio and Research Corporation.

TRADE NAME: Melco Supreme.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: Amsco Products, Inc.
NOTE: The price of the slant panel type is $165.00.

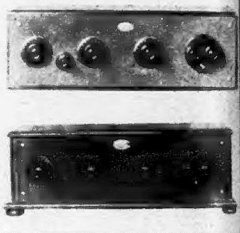
TRADE NAME: Deresnadyne.
MODEL: De luxe.
TYPE: Two stages of tuned radio frequency amplification detector, two stages of low ratio audio frequency amplification.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outdoor, indoor.
PRICE: $165 without accessories.
MANUFACTURER'S NAME: A. R. C. Andrews.

TRADE NAME: "Apex Super."
TYPE: Two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $95.00 without accessories.
MANUFACTURER'S NAME: Apex Electric Manufacturing Company.

TRADE NAME: Deresnadyne.
MODEL: Standard.
TYPE: Tuned radio frequency, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: A. R. C. Andrews.

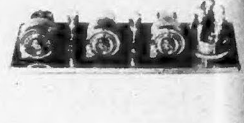
TRADE NAME: "Carryadio."
TYPE: Three stages of radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Six.
BATTERIES: Dry cells contained in case.
CONTROLS: Three.
AERIAL: Loop contained in case.
PRICE: $125.00 including batteries, tubes, loud speaker and loop.
MANUFACTURER'S NAME: Armley Radio Corporation.

TRADE NAME: "Atwater-Kent."
MODEL: 20.
TYPE: Two radio, detector and two audio.
TUBES: Five 201A type.
BATTERIES: Storage "A" and 90-volt "B"
CONTROLS: Four.
AERIAL: Indoor or outdoor.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: Atwater-Kent Mfg. Company.
NOTE: DeLuxe cabinet, $120.00 without accessories.

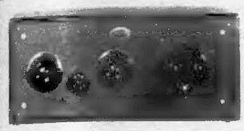


TRADE NAME: "Atwater-Kent."
MODEL: 9.
TYPE: One radio, detector and two audio.
TUBES: Four 201A type.
BATTERIES: Storage "A" and 90-volt "B."
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: Atwater-Kent Mfg. Company.

TRADE NAME: "Atwater-Kent."
MODEL: 10.
TYPE: Two radio, detector and two audio.
TUBES: Five 201A type.
BATTERIES: Storage "A" and 90-volt "B."
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $85.00 without accessories.
MANUFACTURER'S NAME: Atwater-Kent Mfg. Company.



TRADE NAME: "Atwater-Kent."
MODEL: 12.
TYPE: Two radio, detector and two audio.
TUBES: Six 201A type.
BATTERIES: 6-volt storage "A" and 90-volt "B."
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $105.00 without accessories.
MANUFACTURER'S NAME: Atwater-Kent Mfg. Company.



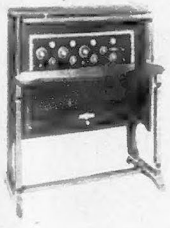
TRADE NAME: "Atwater-Kent."
MODEL: 19.
TYPE: One-stage tuned radio, detector and two audio.
TUBES: Four 201A type.
BATTERIES: 6-volt storage "A" and 90-volt "B."
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $85.00 without accessories.
MANUFACTURER'S NAME: Atwater-Kent Mfg. Company.

TRADE NAME: Adaunit.
MODEL: Portable, built-in loud speaker.
TYPE: Non-regenerative.
TUBES: Three.
BATTERIES: Dry cells used throughout, space provided in cabinet.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $87.50 without accessories.
MANUFACTURER'S NAME: Auto Indicator Co.

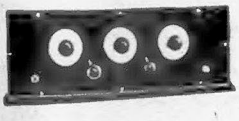
TRADE NAME: Pocket Radio.
MODEL: Standard B.
TYPE: Non-regenerative.
TUBES: One UV-199.
BATTERIES: Dry cells.
CONTROLS: One.
AERIAL: Indoor and outdoor.
PRICE: $23.50 without accessories.
MANUFACTURER'S NAME: Auto Indicator Co.

TRADE NAME: "Superflex Portable."
MODEL: 3-X.
TYPE: One-stage radio frequency amplification, detector and two-stage audio frequency amplification (reflexed).
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: Benson Engineering Co.

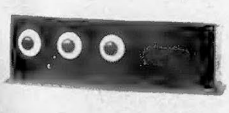
TRADE NAME: "Superflex Loop Receiver."
MODEL: 4-X.
TYPE: Reflex.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: One.
AERIAL: Loop.
PRICE: $90.00 without accessories.
MANUFACTURER'S NAME: Benson Engineering Co.



TRADE NAME: "Console Receiver."
MODEL: 6-C.
TYPE: Tuned radio frequency.
TUBES: Six.
BATTERIES: Contained in cabinet.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $220.00 without accessories.
MANUFACTURER'S NAME: Benson Engineering Co.



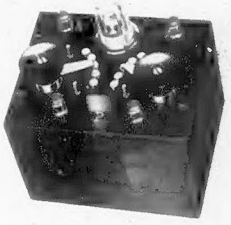
TRADE NAME: "Biltmore Radio Receiver."
MODEL: T-5.
TYPE: Two stages of radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: Biltmore Radio Company.



TRADE NAME: "Master Reflex."
MODEL: 1-V.
TYPE: Reflex with crystal detector.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: Biltmore Radio Company.

TRADE NAME: "Master Reflex."
MODEL: V.
TYPE: Reflex with fixed crystal detector; four stages radio frequency amplification and three stages of audio frequency amplification.
TUBES: Five.
BATTERIES: "A," "B" and "C" required.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: Biltmore Radio Company.

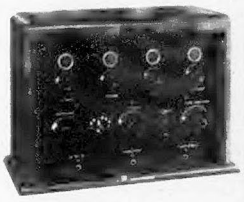
TRADE NAME: Crystal Receiver.
TYPE: Fixed crystal receiver, no tubes or batteries required.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $6.00 without accessories.
MANUFACTURER'S NAME: Bird Radio Corp.



TRADE NAME: "Cincodyne."
MODEL: Blue Seal.
TYPE: Two-stage radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished. "A" and "B."
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $135.00 without accessories.
MANUFACTURER'S NAME: Blue Seal Manufacturing Company.

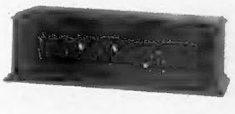
TRADE NAME: "Blue Seal."
MODEL: 4.
TYPE: One radio, detector and two audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $70.00 without accessories.
MANUFACTURER'S NAME: Blue Seal Manufacturing Company.

TRADE NAME: Blue Seal.
MODEL: Five.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Four.
AERIAL: Inside or outside.
PRICE: $140.00 without accessories.
MANUFACTURER'S NAME: Blue Seal Manufacturing Company.

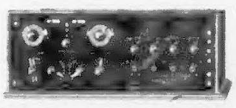


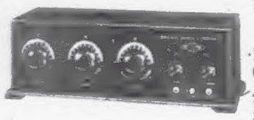
TRADE NAME: "Super-Flex."
MODEL: Consolette.
TYPE: Reflex; built-in loud speaker.
TUBES: Three.
BATTERIES: furnished.
CONTROLS: Three.
AERIAL: Outside.
PRICE: $89.50.
MANUFACTURER'S NAME: Bosserman Radio Laboratory.

TRADE NAME: "Super-Heterodyne."
MODEL: Regular.
TYPE: Super-Heterodyne.
TUBES: Eight UV-199.
BATTERIES: "A," "B" and "C" furnished.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $149 complete.
MANUFACTURER'S NAME: Bosserman Radio Laboratory.

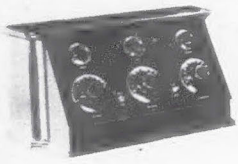


TRADE NAME: "Breco."
MODEL: BSC-3.
TYPE: Detector and three audio.
TUBES: Four.
BATTERIES: "A" and "B."
CONTROLS: Six.
AERIAL: Indoor or outdoor.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: Bronx Radio Equipment Company.

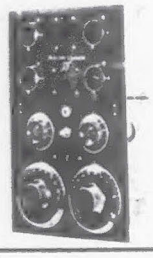




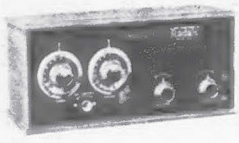
TRADE NAME: "Ray-odyne."
MODEL: C-15.
TYPE: Two stages of radio frequency amplification, detector and two stages of audio frequency amplification.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $75.00.
MANUFACTURER'S NAME: Brown Radio Corp.



TRADE NAME: Malone-Lemmon Neutrodyne Receiver.
TYPE: Hazeltine neutrodyne circuit.
TUBES: Five.
BATTERIES: No batteries furnished.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $175.00 without accessories.
MANUFACTURER'S NAME: Carloyd Electric & Radio Co.



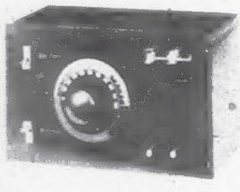
TRADE NAME: Malone-Lemmon Neutrophone Panel.
MODEL: ML-400.
TYPE: Neutrodyne circuit.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outdoor and indoor.
PRICE: $104.00 without accessories.
MANUFACTURER'S NAME: Carloyd Electric & Radio Co.



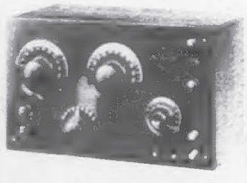
TRADE NAME: "Radak."
MODEL: DD.
TYPE: Armstrong regenerative double variometer type.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $38.00 without accessories.
MANUFACTURER'S NAME: Clapp Eastham Company.

TRADE NAME: Cleartone Perfect Crystal Set.
TYPE: Fixed crystal detector. Cleartone circuit.
CONTROLS: One.
AERIAL: Outside.
PRICE: $7.50 without accessories.
MANUFACTURER'S NAME: Cleartone Radio Supply Co.

TRADE NAME: "Lafayette Neutrodyne."
MODEL: K60.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $160.00 without accessories.
MANUFACTURER'S NAME: The Kor-Rad Company, Inc.



TRADE NAME: Concert Junior.
TYPE: Crystal set.
CONTROLS: One.
AERIAL: Outdoor.
PRICE: $3.50 without accessories.
MANUFACTURER'S NAME: The Concert Radio Phone Co.



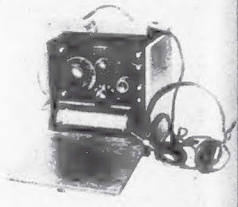
TRADE NAME: Concert Monotube.
TYPE: Three circuit regenerative.
TUBES: One.
CONTROLS: Three.
BATTERIES: Not furnished.
AERIAL: Outdoor.
PRICE: $12.50 without accessories.
MANUFACTURER'S NAME: The Concert Radio Phone Co.

TRADE NAME: Concert Tritube.
TYPE: Three circuit regenerative with two stages of audio frequency.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Outdoor.
PRICE: $35.00 without accessories.
MANUFACTURER'S NAME: The Concert Radio Phone Co.

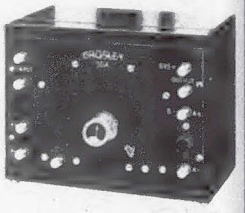
TRADE NAME: Concert Grand.
TYPE: Two tuned radio frequency, detector and two audio.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor and outdoor.
PRICE: $120.00 without accessories.
MANUFACTURER'S NAME: The Concert Radio Phone Co.

TRADE NAME: "Crosley Amplifier."
MODEL: 51-A.
TYPE: Audio frequency amplifier.
TUBES: One.
BATTERIES: None furnished.
PRICE: $14.00.
MANUFACTURER'S NAME: Crosley Radio Corp.

TRADE NAME: "Crosley Regenerative."
MODEL: 50.
TYPE: Armstrong regenerative.
TUBES: One.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $14.50 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.

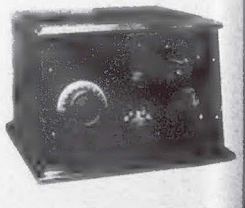


TRADE NAME: "Crosley Regenerative Portable."
MODEL: 50-P.
TYPE: Armstrong regenerative.
TUBES: One.
BATTERIES: Dry cell, self-contained.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $16.00 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.

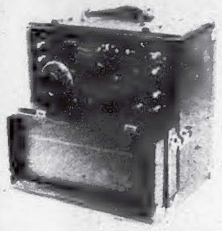


TRADE NAME: "Crosley Amplifier."
MODEL: 50-A.
TYPE: Two-stage audio frequency amplifier.
TUBES: Two.
BATTERIES: None furnished.
PRICE: $18.00.
MANUFACTURER'S NAME: Crosley Radio Corp.

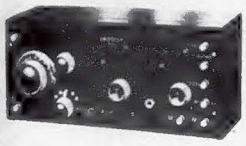
TRADE NAME: "Crosley Regenerative Receiver."
MODEL: 51.
TYPE: Armstrong regenerative.
TUBES: Two.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $18.50 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.



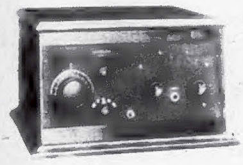
TRADE NAME: "Crosley Regenerative Receiver."
MODEL: 51 special.
TYPE: Armstrong regenerative.
TUBES: Two.
BATTERIES: None furnished, but may be contained in cabinet.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $23.50 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.



TRADE NAME: "Crosley Regenerative Receiver, Portable."
MODEL: 51-P.
TYPE: Armstrong regenerative.
TUBES: Two.
BATTERIES: Self-contained in cabinet.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $23.50.
MANUFACTURER'S NAME: Crosley Radio Corp.



TRADE NAME: "Crosley Regenerative Receiver."
MODEL: 52.
TYPE: Armstrong regenerative.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $30.00 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.

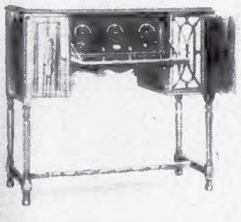


TRADE NAME: "Crosley Regenerative Receiver."
MODEL: 52 special.
TYPE: Armstrong regenerative.
TUBES: Three.
BATTERIES: Not furnished, but can be contained in cabinet.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $35.00 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.

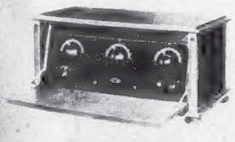
TRADE NAME: "Crosley Trirdyn."
TYPE: Armstrong regenerative; reflex and tuned radio frequency.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $50.00 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.

TRADE NAME: "Crosley Trirdyn."
MODEL: Special.
TYPE: Armstrong regenerative; reflex and tuned radio frequency.
TUBES: Three.
BATTERIES: Not furnished, but may be contained in cabinet.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: Crosley Radio Corp.

TRADE NAME: "Telomonic Three."
TYPE: Three stages tuned radio frequency; crystal or tube detector; two-resistance audio frequency; reflex, and one transformer coupled audio.
TUBES: Seven.
BATTERIES: Not furnished.
CONTROLS: Four.
AERIAL: Outside or inside.
MANUFACTURER'S NAME: Danziger-Jones, Inc.

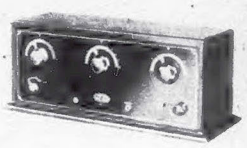


TRADE NAME: "Day-Fan."
MODEL: Daytonia.
TYPE: Two radio, detector and two audio; duplex circuit; complete with "A" and "B" batteries and special recharging apparatus.
BATTERIES: "A" and "B."
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $285.00 complete except tubes.
MANUFACTURER'S NAME: Dayton Fan and Motor Company.



TRADE NAME: "Day-Fan."
MODEL: Dayola.
TYPE: Two radio, detector and two audio; duplex circuit.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: Dayton Fan and Motor Company.

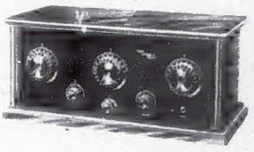
TRADE NAME: "Oem."
MODEL—7 Day-Fan.
TYPE: Two-radio frequency, detector and two audio; reflex.
TUBES: Four.
BATTERIES: "A" and "B" needed.
CONTROLS: Four.
AERIAL: Inside or outside.
PRICE: $98.00 without accessories.
MANUFACTURER'S NAME: Dayton Fan and Motor Company.



TRADE NAME: "Duck."
MODEL: Five tuned super.
TYPE: Tuned radio frequency, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Four.
AERIAL: Inside or outside.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: Wm. B. Duck Company.

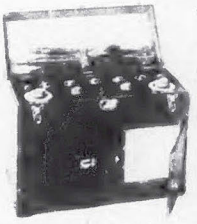
TRADE NAME: "Dynergy."
MODEL: Console A.
TYPE: Operates direct from A.C. or D.C. house lighting line; needs no antenna.
TUBES: Five.
BATTERIES: None needed.
CONTROLS: Three.
PRICE: For A.C. $235.00; for D.C. $185.00.
MANUFACTURER'S NAME: Dynamotive Radio Corporation.

TRADE NAME: Eagle Balanced Neutrodyne.
MODEL: B.
TYPE: Hazeltine neutrodyne set.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $175 without accessories.
MANUFACTURER'S NAME: Eagle Radio Company.



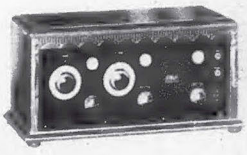
TRADE NAME: Eagle Balanced Neutrodyne.
MODEL: Console.
TYPE: Hazeltine neutrodyne set.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $275 with built-in loud speaker.
MANUFACTURER'S NAME: Eagle Radio Company.

TRADE NAME: "Erla Portable Receiver."
MODEL: Portable built-in loud speaker.
TYPE: Five-tube SuperFlex.
TUBES: Five.
BATTERIES: Dry-cell "A" and "B." Not furnished.
CONTROLS: One.
AERIAL: Loop. Furnished with set.
PRICE: $145.00 without tubes or batteries.
MANUFACTURER'S NAME: Electrical Research Labs.



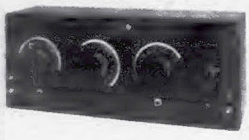
TRADE NAME: "Erla Floor Console."
MODEL: Cabinet built-in loud speaker.
TYPE: Five-tube SuperFlex.
TUBES: Five.
BATTERIES: Storage "A" and 60 to 90 volts "B." None furnished.
CONTROLS: Two.
AERIAL: Outdoor or loop.
PRICE: $270.00 without tubes or batteries.
MANUFACTURER'S NAME: Electrical Research Labs.

TRADE NAME: "Erla Table Cabinet."
MODEL: Cabinet.
TYPE: SuperFlex.
TUBES: Three, four or five.
BATTERIES: Storage batteries for three and four-tube sets, dry cells for five-tube set.
CONTROLS: Two.
AERIAL: Outside with three and four-tube sets, loop with five-tube set.
PRICE: Three-tube, $85.00; four-tube, $95.00; five-tube, $105.00 without accessories.
MANUFACTURER'S NAME: Electrical Research Labs.

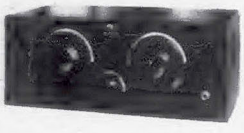


TRADE NAME: Super Reinartz.
TYPE: Regenerative circuit using a combination of the Hartley and Reinartz circuits.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $57.60.
MANUFACTURER'S NAME: Elgin Radio Supply Co.

TRADE NAME: Claratone.
TYPE: Tuned radio frequency, detector and audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $50.00 without accessories.
MANUFACTURER'S NAME: Equitable Radio Corp.

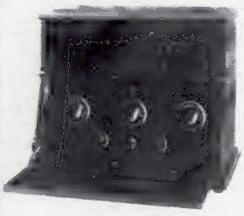


TRADE NAME: "Fada."
MODEL: 160.
TYPE: Two stages tuned radio, detector and two audio.
TUBES: Four.
BATTERIES: "A," 6-volt storage; "B," 60 to 90 volts.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $120.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.



TRADE NAME: "Fada."
MODEL: Neutro-Junior.
TYPE: One-stage radio, detector and two audio.
TUBES: Three.
BATTERIES: None furnished. "A" and "B" needed.
AERIAL: Outside.
CONTROLS: Two.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

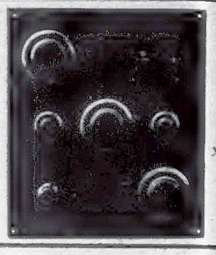
TRADE NAME: "Fada."
MODEL: Neutro-Lagrand.
TYPE: Two tuned neutralized radio, detector and two audio, built-in loud speaker.
TUBES: Five.
BATTERIES: Furnished.
CONTROLS: Three.
AERIAL: Outside and inside.
PRICE: $270.00 complete with built-in loud speaker.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.



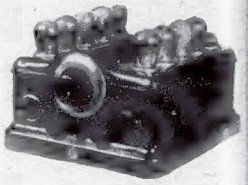
TRADE NAME: "Fada."
MODEL: Neutrola; built-in loud speaker.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90 "B." Not furnished.
CONTROLS: Three.
AERIAL: Outside.
PRICE: $220.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

TRADE NAME: "Fada."
MODEL: Neutro Receiver Grand.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $210.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.

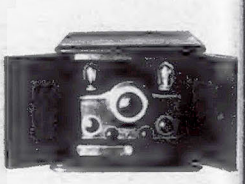
TRADE NAME: "Fada."
MODEL: Neutroreceiver.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $160.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.



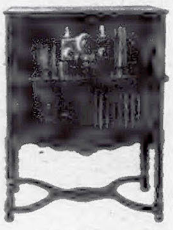
TRADE NAME: "Fada."
MODEL: Victor Console.
TYPE: Neutrodyne; two tuned radio, detector and two audio for installation in Victor Console Model Phonograph No. V.V. 215.
TUBES: Five.
BATTERIES: 6-volt "A," 60 to 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: F. A. D. Andrea, Inc.



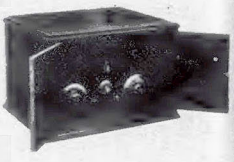
TRADE NAME: "Farrand Godley."
MODEL: Single 9.
TYPE: Five-stage neutralized tuned radio frequency, detector and three audio.
TUBES: Nine.
BATTERIES: "A," 6 volts; "B," 90 and 22½.
CONTROLS: One.
AERIAL: Loop inside or outside.
PRICE: $195.00 without accessories.
MANUFACTURER'S NAME: Farrand Mfg. Company.



TRADE NAME: "Farrand Godley."
MODEL: Single 9 in cabinet.
TYPE: Five-stage neutralized tuned radio frequency, detector and three audio.
TUBES: Nine.
BATTERIES: "A," 6 volts; "B," 90 and 22½.
CONTROLS: One.
AERIAL: Loop inside or outside.
PRICE: $235.00 without accessories.
MANUFACTURER'S NAME: Farrand Mfg. Company.

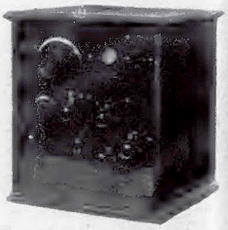


TRADE NAME: "Farrand Godley."
MODEL: Single 9 with built-in loud speaker, De Luxe cabinet.
TYPE: Five-stage neutralized tuned radio frequency, detector and three audio.
TUBES: Nine.
BATTERIES: "A," 6 volts; "B," 90 and 22½.
CONTROLS: One.
AERIAL: Loop inside or outside.
PRICE: $375.00 without accessories.
MANUFACTURER'S NAME: Farrand Mfg. Company.



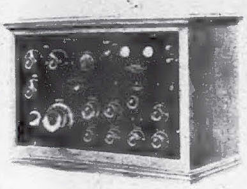
TRADE NAME: Federal.
MODEL: Type 141.
TYPE: Two transformer coupled radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.

TRADE NAME: Federal.
MODEL: 161.
TYPE: Three transformer coupled radio, detector and three audio with built-in loud speaker.
TUBES: Six.
BATTERIES: None furnished.
CONTROLS: Three main.
AERIAL: Outdoor or loop.
PRICE: $464.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.

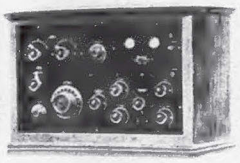


TRADE NAME: Federal.
MODEL: 110.
TYPE: One radio, detector and one audio.
TUBES: Three.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outdoor.
PRICE: $105.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.

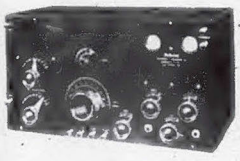
TRADE NAME: Federal.
MODEL: 102 portable.
TYPE: One transformer radio, detector and two audio.
TUBES: Four, dry cell type.
BATTERIES: None furnished.
CONTROLS: One.
AERIAL: Outdoor.
PRICE: $140.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.



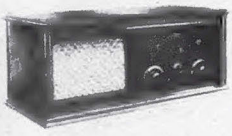
TRADE NAME: Federal.
MODEL: 61.
TYPE: Three stages transformer coupled radio, detector and two audio.
TUBES: Six.
BATTERIES: None furnished.
CONTROLS: Four.
AERIAL: Outdoor or loop.
PRICE: $223.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.



TRADE NAME: Federal.
MODEL: 59.
TYPE: One-stage transformer coupled radio, detector and two audio.
TUBES: Four
BATTERIES: None furnished.
CONTROLS: Four.
AERIAL: Outside or inside.
PRICE: $177.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.



TRADE NAME: Federal.
MODEL: 58.
TYPE: One-stage transformer coupled radio, detector and two audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Four.
AERIAL: Outside.
PRICE: $123.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.



TRADE NAME: Federal.
MODEL: 142.
TYPE: Built-in loud speaker.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $230.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.

TRADE NAME: Federal.
MODEL: 143.
TYPE: Built-in loud speaker.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $330.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.

TRADE NAME: Federal.
MODEL: 144.
TYPE: Built-in loud speaker.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $330.00 without accessories.
MANUFACTURER'S NAME: Federal Telephone & Telegraph Corp.

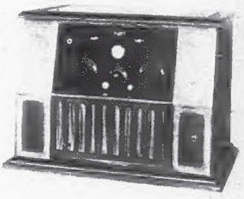
TRADE NAME: Freshman Masterpiece.
TYPE: Self-balanced tuned radio frequency receiver.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $60.00.
MANUFACTURER'S NAME: Chas. Freshman Co., Inc.

TRADE NAME: "Garod."
MODEL: RAF.
TYPE: Neutrodyne.
TUBES: Four.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Outside or Inside.
PRICE: $135.00 without accessories.
MANUFACTURER'S NAME: Garod Corporation.

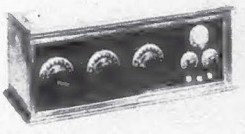
TRADE NAME: "Garod."
MODEL: V.
TYPE: Neutrodyne; two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $195.00 without accessories.
MANUFACTURER'S NAME: Garod Corporation.

TRADE NAME: Cameo.
MODEL: A.
TYPE: Three stages radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" 6-volt, "B" 90 volts.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $125.00.
MANUFACTURER'S NAME: General American Radio Manufacturing Corp.

TRADE NAME: Jewel.
MODEL: B.
TYPE: Three stages radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" 6-volt, "B" 90 volts.
CONTROLS: Three.
PRICE: $175.00.
AERIAL: Inside or outside.
MANUFACTURER'S NAME: General American Radio Manufacturing Corp.

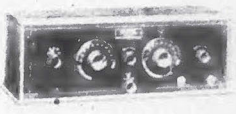


TRADE NAME: "Gilfillan."
MODEL: GN-2.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $140.00.
MANUFACTURER'S NAME: Gilfillan, Inc.

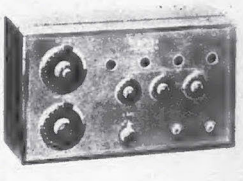


TRADE NAME: "Gilfillan."
MODEL: GN-1.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $175.00 without accessories.
MANUFACTURER'S NAME: Gilfillan, Inc.

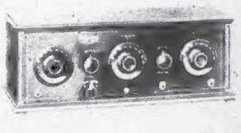
TRADE NAME: "Duo-Dyne Receiver."
MODEL: 770.
TYPE: One stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Four.
BATTERIES: None furnished
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $55.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.



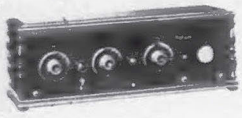
TRADE NAME: "Duo-Dyne Receiver."
MODEL: 775
TYPE: One stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $80.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.



TRADE NAME: "Duo-Dyne Receiver."
MODEL: 880.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.



TRADE NAME: "Duo-Dyne Receiver."
MODEL: 815.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Four.
AERIAL: Outdoor or indoor.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.



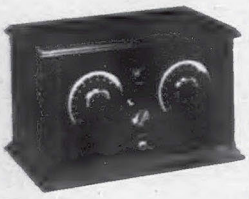
TRADE NAME: "Duo-Dyne Receiver."
MODEL: 900.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $135.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.

TRADE NAME: "Console with Duo Dyne Receiver 770."
MODEL: 772.
TYPE: Same as the 770 receiver with built-in loud speaker.
TUBES: Four.
BATTERIES: None furnished, but may be self-contained.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $140.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.

TRADE NAME: "Console with Duo-Dyne Receiver 900."
MODEL: 902.
TYPE: Same as Model 900 with Magnavox built-in loud speaker.
TUBES: Five.
BATTERIES: furnished, self-
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $310.00 without accessories.
MANUFACTURER'S NAME: Globe Electric Company.

TRADE NAME: "Super-Pliodyne.
MODEL: 9.
TYPE: Five stages of tuned radio frequency, detector and three stages of audio frequency amplification.
TUBES: Nine.
BATTERIES: "A," "B" and "C" needed.
CONTROLS: One.
AERIAL: Loop.
PRICE: $295.00 without accessories.
MANUFACTURER'S NAME: Golden-Leutz, Inc.

TRADE NAME: "Pliodyne."
MODEL: 6.
TYPE: Two stages tuned radio frequency, detector and three stages of audio frequency amplification.
TUBES: Six.
BATTERIES: "A," "B" and "C" needed.
CONTROLS: Three.
AERIAL: Outdoor, indoor.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: Golden-Leutz, Inc.



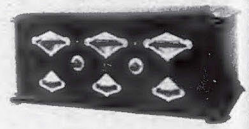
TRADE NAME: Radyne.
MODEL: H.
TYPE: One-stage radio frequency, detector and two stages of audio frequency amplification, one-stage being reflexed.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $70.00 without accessories, f. o. b. San Francisco.
MANUFACTURER'S NAME: Great Western Radio Corp.

TRADE NAME: Radyne.
MODEL: A.
TYPE: Two stages radio frequency, detector and two audio frequency amplification.
TUBES: Five UV-199.
BATTERIES: Dry cells. Space provided for batteries in cabinet.
CONTOLS: Three.
AERIAL: Inside or outside.
PRICE: $130.00 without accessories, f. o. b. San Francisco.
MANUFACTURER'S NAME: Great Western Radio Corp.

TRADE NAME: Radyne.
MODEL: F.
TYPE: Two radio frequency, detector and two audio frequency.
TUBES: Five.
BATTERIES: Not furnished. Room for "B" and "C" batteries in cabinet.
AERIAL: Inside or outside.
CONTROLS: Three.
PRICE: $140.00 without accessories, f. o. b. San Francisco.
MANUFACTURER'S NAME: Great Western Radio Corp.

TRADE NAME: Radyne.
MODEL: Console table.
TYPE: Two stages of radio frequency, detector and two audio frequency.
TUBES: Five.
BATTERIES: Not furnished, but room provided for all batteries in cabinet.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $275.00 without accessories, but including built-in loud speaker.
MANUFACTURER'S NAME: Great Western Radio Corp.

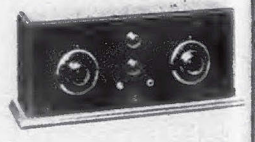
TRADE NAME: Grebe Synchrophase.
MODEL:
TYPE: Two tuned radio, detector and two audio, last stage parallel tubes.
TUBES: Six 199 type.
BATTERIES: None furnished.
ANTENNA: Inside or outside.
CONTROLS: 3.
PRICE: $155.00.
MANUFACTURER'S NAME: A. H. Grebe & Co.
NOTE: This same set furnished with tubes of the 201A type (Model NU-1).



TRADE NAME: Grebe Synchrophase.
MODEL: NU-2.
TYPE: Two tuned radio, detector, and two audio, last stage parallel; with battery case.
TUBES: Six 199 type.
BATTERIES: None furnished.
ANTENNA: Inside or outside.
CONTROLS: 3.
PRICE: $170.00.
MANUFACTURER'S NAME: A. H. Grebe & Co.
NOTE: This same set furnished with tubes 201A type (Model NU-1).

TRADE NAME: "Gundlach Crystal Receiving Set."
TYPE: Crystal receiver; no batteries or tubes needed.
CONTROLS: Two.
AERIAL: Outside.
PRICE: Without antenna or phones $6.00.
MANUFACTURER'S NAME: Gundlach Manhattan Optical Company.

TRADE NAME: "Halldorson 4-Tube Set."
MODEL: RD 400.
TYPE: One stage of tuned radio, detector and two stages of audio frequency amplification.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outdoor, indoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: The Halldorson Company.

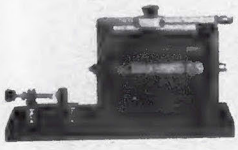


TRADE NAME: "Halldorson 5-Tube Set."
MODEL: RF 500.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $115.00 without accessories.
MANUFACTURER'S NAME: The Halldorson Company.

TRADE NAME: "Hallerio."
MODEL: III.
TYPE: Crystal receiver; no tubes or batteries needed.
CONTROLS: Two.
AERIAL: Outside.
PRICE: $3.00 without telephone receivers or antenna.
MANUFACTURER'S NAME: W. B. Haller.

TRADE NAME: "Hallerio."
MODEL V.
TYPE: Crystal detector; no tubes or batteries needed.
CONTROLS: One.
AERIAL: Outside.
PRICE: $5.00 without telephone receivers or antenna.
MANUFACTURER'S NAME: W. B. Haller.

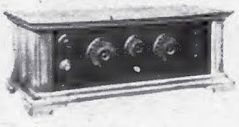
TRADE NAME: "Hallerio."
MODEL: IV.
TYPE: Crystal detector; no tubes or batteries needed.
CONTROLS: One.
AERIAL: Outside.
PRICE: $4.00 without telephone receivers or antenna.
MANUFACTURER'S NAME: W. B. Haller.



TRADE NAME: "Hallerio."
MODEL: 1½.
TYPE: Crystal detector; no tubes or batteries needed.
CONTROLS: One.
AERIAL: Outside.
PRICE: $1.50 without telephone receivers or antenna.
MANUFACTURER'S NAME: W. B. Haller.

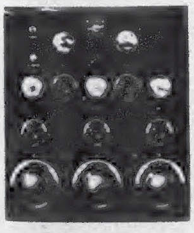
TRADE NAME: "Hallerio."
MODEL: 3½.
TYPE: Crystal detector; no tubes or batteries needed.
CONTROLS: One.
AERIAL: Outside.
PRICE: $3.50 without telephone receivers or antenna.
MANUFACTURER'S NAME: W. B. Haller.

TRADE NAME: Harcourt Reflex.
MODEL: Erla.
TYPE: Reflex.
TUBES: Three.
BATTERIES: None furnished.
CONTROLS: Five.
AERIAL: Outside or inside.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: Harcourt Radio Company.



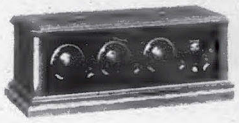
TRADE NAME: "Harmonson."
MODEL: IV-C.
TYPE: One-stage tuned radio frequency amplification, detector and two stages audio.
TUBES: Four.
BATTERIES: Storage "A"; 90 volts "B."
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $130.00 without accessories; $185.00 with accessoires furnished.
MANUFACTURER'S NAME: H. W. Harmon & Sons Co.

TRADE NAME: "Harmonson."
MODEL: IV-C Grand with built-in loud speaker.
TYPE: One-stage tuned radio, detector and two audio.
TUBES: Four.
BATTERIES: Storage "A"; 90 volts "B."
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $160.00 without accessories, $205.00 with accessories.
MANUFACTURER'S NAME: W. H. Harmon & Sons Co.

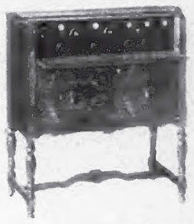


TRADE NAME: Howard Neutrodyne Receiver.
MODEL: For phonograph adaption.
TYPE: Hazeltine neutrodyne.
TUBES: Five.
BATTERIES: "A" and "B."
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $180.00.
MANUFACTURER'S NAME: Howard Manufacturing Co.

TRADE NAME: Howard Hazeltine Receiver.
MODEL: Table.
TYPE: Hazeltine neutrodyne.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $135 without accessories.
MANUFACTURER'S NAME: Howard Mfg. Co.



TRADE NAME: Howard Neutrodyne Receiver.
MODEL: Console.
TYPE: Hazeltine neutrodyne.
TUBES: Four.
BATTERIES: Contained in cabinet.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $325 with loud speaker.
MANUFACTURER'S NAME: Howard Mfg. Co.



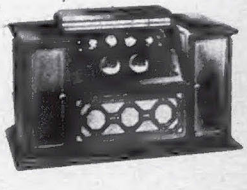
TRADE NAME: Bestone.
MODEL: V-60.
TYPE: Two stages tuned radio frequency, detector and two audio frequency.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $100.00.
MANUFACTURER'S NAME: Henry Hyman & Co.

TRADE NAME: Bestone.
MODEL: V-60.
TYPE: Tuned radio frequency, detector and two audio frequency with built-in loud speaker.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $150.00.
MANUFACTURER'S NAME: Henry Hyman & Co.

TRADE NAME: "Kennedy."
MODEL: V.
TYPE: Detector and two audio.
TUBES: Three.
BATTERIES: Dry cell or storage, depending on tubes, 45 to 60 volts "B."
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: Colin B. Kennedy Company.

TRADE NAME: "Kennedy."
MODEL: VI.
TYPE: Detector and three audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside.
PRICE: $105.00 without accessories.
MANUFACTURER'S NAME: Colin B. Kennedy Company.

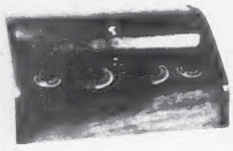
TRADE NAME: "Kennedy."
MODEL: XV.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $142.50 without accessories.
MANUFACTURER'S NAME: Colin B. Kennedy Company.



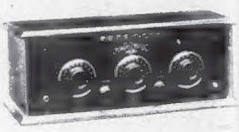
TRADE NAME: "Kennedy."
MODEL: XI with built-in loud speaker.
TYPE: Detector and three audio.
TUBES: Four.
BATTERIES: "A" and "B" needed.
CONTROLS: Two.
AERIAL: Outside.
PRICE: $185.00 without accessories.
MANUFACTURER'S NAME: Colin B. Kennedy Company.

TRADE NAME: "Microdyne."
MODEL: 550-EM.
TYPE: Two radio frequency, two detectors, two audio frequency and oscillator with built-in loud speaker.
TUBES: Seven.
BATTERIES: "A," "B" and "C" needed.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $400.00 without accessories.
MANUFACTURER'S NAME: Lakeside Supply Company.

TRADE NAME: Magnavox receiving Set.
MODEL: TRF-50.
TYPE: Tuned radio frequency.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $150.00.
MANUFACTURER'S NAME: Magnavox Co.



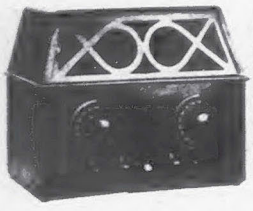
TRADE NAME: "Master Craft Junior."
MODEL: 12-4.
TYPE: One-stage tuned radio frequency, detector and two audio.
TUBES: Four.
BATTERIES: "A" storage; "B" 90 volts.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: LaMar Manufacturing Co., Inc.



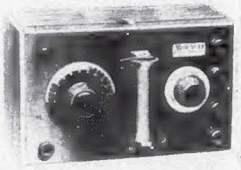
TRADE NAME: "Magnutrol."
TYPE: Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: Magnus Electric Company, Inc.

TRADE NAME: Master Craft DeLuxe.
MODEL: 18-4.
TYPE: One-stage radio frequency.
TUBES: Four.
BATTERIES: "A" 6-volt storage; "B," 90 volts.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: LaMar Manufacturing Co., Inc.

TRADE NAME: "Midland Radio Frequency Receiver."
TYPE: Radio frequency, detector and audio frequency.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $35.00 without accessories.
MANUFACTURER'S NAME: Midland Electric Mfg. Company.

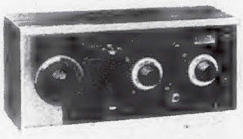


TRADE NAME: Master Craft Grand.
MODEL: 14-4.
TYPE: One-stage tuned radio frequency.
TUBES: Four.
BATTERIES: "A," 6-volt storage; "B," 90 volts.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $85.00 without accessories.
MANUFACTURER'S NAME: LaMar Manufacturing Co., Inc.



TRADE NAME: Miraco.
MODEL: "R."
TYPE: Tuned radio frequency circuit.
TUBES: One.
BATTERIES: Dry cells.
CONTROLS: One.
AERIAL: Outdoor.
PRICE: $14.35 without accessories.
MANUFACTURER'S NAME: Midwest Radio Corporation.

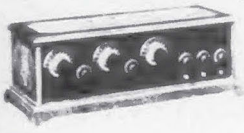
TRADE NAME: Master Craft Aristocrat.
MODEL: 15-4.
TYPE: One-stage tuned radio frequency, detector and two-stage audio frequency amplification.
TUBES: Four.
BATTERIES: "A," 6-volt storage; "B," 90 volts.
CONTROLS: Two.
AERIAL: Indoor, outdoor.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: LaMar Manufacturing Co., Inc.



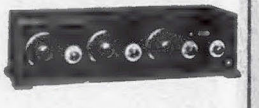
TRADE NAME: Miraco.
MODEL: R-3.
TYPE: Tuned radio frequency circuit.
TUBES: Three.
BATTERIES: Not furnished.
CONTROLS: One.
AERIAL: Indoor and outdoor.
PRICE: $29.50 without accessories.
MANUFACTURER'S NAME: Midwest Radio Corporation.

TRADE NAME: "The Lasher Capacidyne."
TYPE: Two stages radio frequency amplification, detector and two stages of audio frequency amplification; built-in loud speaker.
TUBES: Five.
BATTERIES: Not furnished, "B" battery compartment in cabinet.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $175.00 without accessories.
MANUFACTURER'S NAME: LaMar Manufacturing Co., Inc.

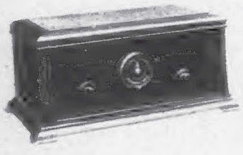
TRADE NAME: Miraco.
MODEL: MW.
TYPE: Tuned radio frequency circuit.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Outdoor and indoor.
PRICE: $54.50 without accessories.
MANUFACTURER'S NAME: Midwest Radio Corporation.



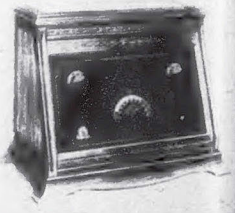
TRADE NAME: "Liberty Sealed Five."
TYPE: Transformer coupled tuned radio frequency, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: Liberty Transformer Company.



TRADE NAME: Miraco.
MODEL: Ultra-5.
TYPE: Tuned radio frequency circuit.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Outdoor and indoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: Midwest Radio Corporation.

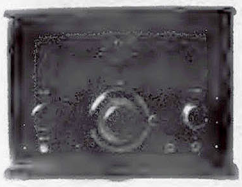


TRADE NAME: Magnavox Receiving Set.
MODEL TRF-5.
TYPE: Tuned radio Frequency..
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Outdoor and indoor.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: Magnavox Co.



TRADE NAME: "Mohawk."
MODEL: VA.
TYPE: Five-tube single control.
TUBES: Five.
BATTERIES: "A" and "B."
CONTROLS: One.
AERIAL: Outside or Inside.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: Mohawk Electric Corporation.

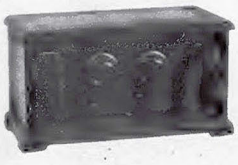
TRADE NAME: "Mohawk."
MODEL: XLI.
TYPE: Uni-control built-in loud speaker.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: One.
AERIAL: Inside or outside.
PRICE: $300.00 without accessories.
MANUFACTURER'S NAME: Mohawk Electric Corporation.



TRADE NAME: Terafone.
MODEL: TA.
TYPE: Two stages of radio frequency, detector and two stages of A.F.A. using the Satterlee antennaless circuit.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: One.
AERIAL: None needed but will work on any type.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: The Moon Radio Corporation.

TRADE NAME: "Murdock."
TYPE: Neutrodyne with built-in loud speaker.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $100.00 without accessories.
MANUFACTURER'S NAME: Wm. J. Murdock Company.

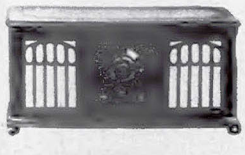
TRADE NAME: Federal-Danersk.
TYPE: Two radio frequency detector and two audio.
TUBES: Five.
BATTERIES: "A," 6-volt storage; "B," 90 volts.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $325.00 with accessories.
MANUFACTURER'S NAME: Musical Products Distributing Company, New York.



TRADE NAME: "Somerset Stratford."
MODEL: 4-A.
TYPE: One stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Four.
BATTERIES: None furnished; may be self-contained in cabinet.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: National Airphone Corp.

TRADE NAME: "Summerset Mars."
MODEL: 5-A.
TYPE: Two stages of tuned audio frequency amplification, detector and two stages of audio.
TUBES: Five.
BATTERIES: 6-volt "A" storage can be self-contained in cabinet; "B," 60 to 90 volts, can be self-contained in cabinet.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: National Airphone Corp.

TRADE NAME: "Somerset Shelbourne."
MODEL: 4-B.
TYPE: One-stage tuned radio frequency amplification, detector and two stages of audio.
TUBES: Four.
BATTERIES: Full-size 6-volt storage "A" battery; can be self-contained in cabinet.
CONTROLS: One.
AERIAL: Indoor or outdoor.
PRICE: $85.00 without accessories.
MANUFACTURER'S NAME: National Airphone Corp.



TRADE NAME: "Somerset Standish."
MODEL: 4-C.
TYPE: One-stage tuned radio frequency amplification, detector and two stages of audio.
TUBES: Four.
BATTERIES: Full-size 6-volt storage "A" battery; can be self-contained in cabinet.
CONTROLS: One.
AERIAL: Outdoor or indoor.
PRICE: $150.00 including built-in loud speaker.
MANUFACTURER'S NAME: National Airphone Corp.

TRADE NAME: "National Country Gentleman."
MODEL: Portable.
TYPE: One-stage tuned radio, detector and two audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $80.00 without accessories.
MANUFACTURER'S NAME: National Radio Manufacturing Company.

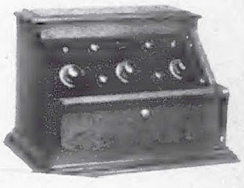
TRADE NAME: "Nyaccoflex Portable."
MODEL: RP-1.
TYPE: Reflex. In same case with phonograph.
TUBES: Two.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $55.00 without accessories.
MANUFACTURER'S NAME: New York Album and Card Co.

TRADE NAME: "Nyaccoflex."
MODEL: R-2.
TYPE: Reflex with crystal detector.
TUBES: Two.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $32.50 without accessories.
MANUFACTURER'S NAME: New York Album and Card Co.

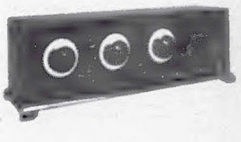
TRADE NAME: "Peak of Perfection."
TYPE: Super-reflex with built-in loud speaker.
TUBES: Four 199 type.
BATTERIES: Dry cell "A" and "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $124.00 without accessories.
MANUFACTURER'S NAME: Parkin Mfg. Company.

TRADE NAME: "Portola."
TYPE: Two radio, detector and two audio with built-in loud speaker and loop antenna.
TUBES: Six 199 type.
BATTERIES: Dry cell "A" and "B."
CONTROLS: Two.
AERIAL: Built-in loop.
PRICE: $160.00 without accessories.
MANUFACTURER'S NAME: Portola Radio Company.

TRADE NAME: Premco Radio Receiver.
MODEL: 102.
TYPE: Tuned radio frequency circuit.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Outdoor and indoor.
PRICE: $60.00.
MANUFACTURER'S NAME: Ports Manufacturing Co.



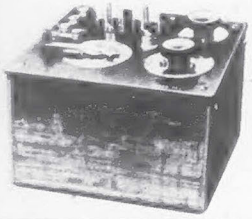
TRADE NAME: "Precel Super 5."
TYPE: Two stages of tuned radio frequency amplification, detector and two stages of power audio frequency amplification.
TUBES: Five.
BATTERIES: Space provided in cabinet.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $130.00 without accessories.
MANUFACTURER'S NAME: Precel Radio Mfg. Co.



TRADE NAME: "Belleclaire."
MODEL: Standard.
TYPE: Two radio frequency, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Four.
AERIAL: Inside or outside.
PRICE: $165.00 without accessories.
MANUFACTURER'S NAME: R. B. Radio Company.

TRADE NAME: "Belleclaire."
MODEL: Console cabinet.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Four.
AERIAL: Inside or outside.
PRICE: $250.00 without accessories.
MANUFACTURER'S NAME: R. B. Radio Company.

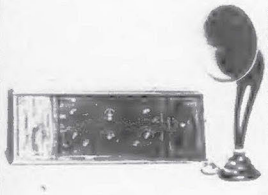
TRADE NAME: "Belleclaire."
MODEL: Knickerbocker with Amplion built-in loud speaker.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Four.
AERIAL: Inside or outside.
PRICE: $350.00 without accessories.
MANUFACTURER'S NAME: R. B. Radio Company.



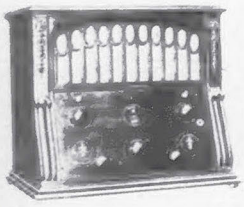
TRADE NAME: "Radiola Receiver."
MODEL: Radiola III.
Type: Regenerative.
TUBES: Two WD-11.
BATTERIES: Dry Cell.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $35.00 without accessories.
MANUFACTURER'S NAME: Radio Corp. of America.

TRADE NAME: "Balanced Amplifier."
MODEL: To be used with Radiola III.
TYPE: Two stages of audio frequency amplification.
TUBES: Two WD-11.
BATTERIES: Dry cells.
PRICE: $30.00 without accessories.
MANUFACTURER'S NAME: Radio Corp. of Ame[illegible].

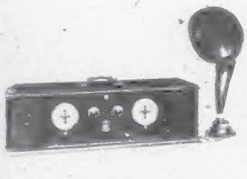
TRADE NAME: "Radiola Receiver."
MODEL: Radiola III-A.
TYPE: Regenerative
TUBES: Four WD-11
BATTERIES: Dry cells.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $65.00 with tubes and head set.
MANUFACTURER'S NAME: Radio Corp of America.



TRADE NAME: "Radiola Receiver."
MODEL: Regenoflex.
TYPE: Reflex.
TUBES: Four WD-11.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $191.00 with tubes and radiola loud speaker.
MANUFACTURER'S NAME: Radio Corp. of America.



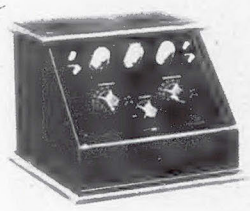
TRADE NAME: "Radiola Receiver."
MODEL: Radiola X.
TYPE: Reflex with built-in loud speaker.
TUBES: Four WD-11.
BATTERIES: Place provided in cabinet.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $245.00 with tubes.
MANUFACTURER'S NAME: Radio Corp. of America.



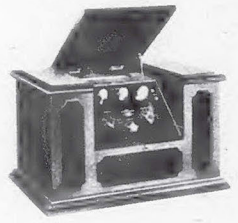
TRADE NAME: "Radiola Receiver."
MODEL: Super-Heterodyne.
TUBES: Six UV-199.
BATTERIES: Contained in cabinet.
AERIAL: Small loop built into set.
PRICE: $220.00 without accessories, $269.00 with tubes and loud speaker.
MANUFACTURER'S NAME: Radio Corp. of America.

TRADE NAME: "Radiola Receiver."
MODEL: Super VIII.
TYPE: Super-Heterodyne. Console.
TUBES: Six UV-199.
BATTERIES: Contained in cabinet.
CONTROLS: Three.
AERIAL: Concealed large loop built into set.
PRICE: $425.00 with tubes and built-in loud speaker.
MANUFACTURER'S NAME: Radio Corp. of America.

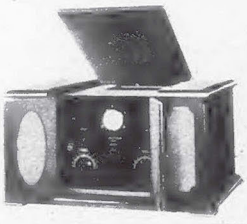
TRADE NAME: Echophone.
MODEL: V-3 standard.
TYPE: Regenerative type.
TUBES: Three.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $50.00 without accessories.
MANUFACTURER'S NAME: The Radio Shop, Inc.



TRADE NAME: Echophone.
MODEL: V-3 Consolette.
TYPE: Regenerative.
TUBES: Three.
BATTERIES: Not furnished but may be contained in cabinet.
CONTROLS: Two.
AERIAL: Outdoor and indoor.
PRICE: $87.50 without accessories.
MANUFACTURER'S NAME: The Radio Shop, Inc.

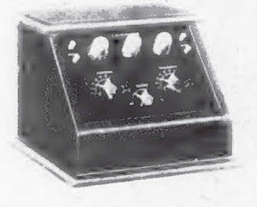


TRADE NAME: Echophone.
MODEL: F. Grand Consolette.
TYPE: Tuned radio frequency circuit.
TUBES: Five.
BATTERIES: Not furnished but may be put in cabinet.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $165.00 without accessories.
MANUFACTURER'S NAME: The Radio Shop, Inc.



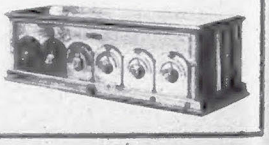
TRADE NAME: Echophone.
MODEL: F. standard.
TYPE: Tuned radio frequency circuit.
TUBES: Five.
BATTERIES: Not furnished but may be put in cabinet.
CONTROLS: Two.
AERIAL: Indoor and outdoor.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: The Radio Shop, Inc.

TRADE NAME: "Echophone."
MODEL: 3.
TYPE: Regenerative detector and two audio.
TUBES: Three 199 type.
BATTERIES: Dry cell "A" and "B."
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $50.00 without accessories.
MANUFACTURER'S NAME: The Radio Shop.



TRADE NAME: "Echophone."
MODEL: 4.
TYPE: One radio frequency, detector and two audio.
TUBES: Four 199 type.
BATTERIES: Dry cell "A" and "B."
CONTROLS: Two.
AERIAL: Loop or outdoor.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: The Radio Shop.

TRADE NAME: "RMP."
MODEL: 50.
TYPE: Tuned radio frequency.
TUBES: Six.
BATTERIES: "A," storage or dry; "B," 90 volts.
CONTROLS: Three.
PRICE: $100.00.
NOTE: Model 51 contains two mounted jacks and switch at same price. Model 52 hand-rubbed walnut cabinet, plate glass front, two mounted jacks and switch. Price $135.00.
MANUFACTURER'S NAME: Radio Products Mfg. Company.



TRADE NAME: Rich.
MODEL: 2-T-12.
TYPE: Reflex.
TUBES: Two.
BATTERIES: Not furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $29.50 without accessories.
MANUFACTURER'S NAME: George H. Rich.

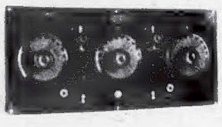
TRADE NAME: Rich.
MODEL: 3-T-22
TYPE: Reflex.
TUBES: Three.
BATTERIES: None furnished.
AERIAL: Outside.
CONTROLS: Three.
PRICE: $50.00 without accessories.
MANUFACTURER'S NAME: George H. Rich.

TRADE NAME: Sears.
MODEL: Standard
TYPE: Reflex.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: One.
AERIAL: Outside.
PRICE: $160.00
MANUFACTURER'S NAME: Sears Mfg. Co.

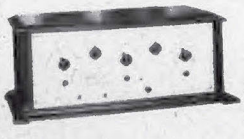
TRADE NAME: Sears.
MODEL: Standard.
TYPE: Acme reflex.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $200.00
MANUFACTURER'S NAME: Sears Mfg. Co.

TRADE NAME: Thermiodyne.
MODEL: TFS.
TYPE: Three radio, detector and two audio.
TUBES: Six.
BATTERIES: None furnished.
CONTROLS: One.
AERIAL: Indoor and outdoor.
PRICE: $140.00
MANUFACTURER'S NAME: Shepard-Potter Co.

TRADE NAME: "Hetro Magnetic."
MODEL: 5-H.
TYPE: Two-stage tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Outside, inside.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: Sidbenel Electric and Mfg. Company.



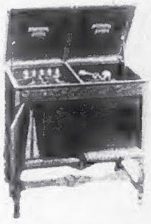
TRADE NAME: "Compendyne."
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: E. Singer Co.



TRADE NAME: Silverset Radio Receiver.
TYPE: Two stages of tuned radio frequency detector and two stages of audio frequency amplification.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $125 without accessories.
MANUFACTURER'S NAME: Silverset Radio Co.

TRADE NAME: "Sleeper Monotrol."
MODEL: 54.
TYPE: Grimes inverse duplex circuit.
TUBES: Four.
BATTERIES: Storage or dry cells.
CONTROLS: One.
AERIAL: Indoor, outdoor or loop.
PRICE: $130.00 without accessories.
MANUFACTURER'S NAME: Sleeper Radio Corp.

TRADE NAME: "Sonoradio."
MODEL: 241, built-in with phonograph.
TYPE: Two radio, detector, and two audio.
TUBES: Five 199 type.
BATTERIES: "A"-3 dry cells, "B"-90 volts.
CONTROLS: Two.
AERIAL: Outdoor or indoor.
PRICE: $475.00 complete with phonograph, but without radio accessories.
MANUFACTURER'S NAME: Sonora Phonograph Company, Inc.

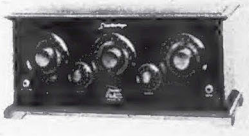


TRADE NAME: "Sonoradio."
MODEL: 242, built-in phonograph.
TYPE: Neutrodyne, reflex radio frequency.
TUBES: Three UV-199.
BATTERIES: "A"-3 dry cells, "B"-90 volts.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $235.00 without accessories.
MANUFACTURER'S NAME: Sonora Phonograph Company, Inc.

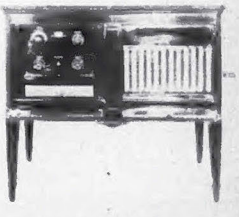
TRADE NAME: "Splitdorf."
MODEL: R-100.
TYPE: Tuned radio frequency.
TUBES: Five.
BATTERIES: None Furnished.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: Splitdorf Electrical Company.

TRADE NAME: "Splitdorf."
MODEL: R-102.
TYPE: Tuned radio frequency with built-in loud speaker.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $235.00 without accessories.
MANUFACTURER'S NAME: Splitdorf Electrical Company.

TRADE NAME: "Standardyne Receiver"
TYPE: Two tuned radio, detector and two audio.
TUBES: Five.
BATTERIES: Dry cell or storage.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: Standard Radio Corp.

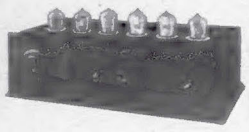


TRADE NAME: "Giblin Broadcast."
MODEL: RL.
TYPE: Two radio frequency, detector and three audio.
TUBES: Six.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: Standard Radio and Electric Corporation.



TRADE NAME: "Giblin Phonograph Broadcast Receiver."
MODEL: TM.
TYPE: Radio frequency with loop aerial.
TUBES: Two radio, detector and two audio.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts.
CONTROLS: Two.
ANTENNA: Loop.
PRICE: $425.00 without accessories.
MANUFACTURER'S NAME: Standard Radio and Electric Corporation.

TRADE NAME: "Giblin Broadcast Receiver."
MODEL: C.
TYPE: Coupled radio frequency.
TUBES: Six, 2 radio frequency, detector and 3 audio frequency.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts; space provided for batteries in cabinet.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $185.00 with loud speaker.
MANUFACTURER'S NAME: Standard Radio and Electric Company.

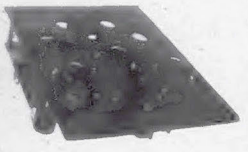


TRADE NAME: "Giblin Broadcast Receiver."
MODEL: 2RA3.
TYPE: Coupled radio frequency.
TUBES: Six, 2 radio frequency, detector and 3 audio frequency amplifiers.
BATTERIES: "A" 6-volt storage; "B" 90 volts; "C" 4½ volts.
CONTROLS: Two.
AERIAL: Loop.
PRICE: $110.00 without accessories.
MANUFACTURER'S NAME: Standard Radio and Electric Company.

TRADE NAME: Stromberg-Carlson.
TYPE: Hazeltine neutrodyne.
MODEL: No. 1A.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor, outdoor.
PRICE: $180 with headset; no other accessories.
MANUFACTURER'S NAME: Stromberg-Carlson Mfg. Co.

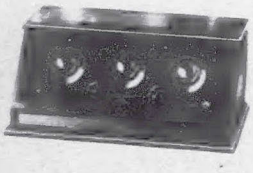
TRADE NAME: "Terlee Acme Reflex."
TYPE: One-stage tuned radio frequency, three stages of untuned detector and three stages of untuned audio; crystal detector.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $165.00 without accessories.
MANUFACTURER'S NAME: Terlee Electric and Manufacturing Company.

TRADE NAME: "Timson."
TYPE: Tuned radio frequency.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outdoor or indoor.
PRICE: $60.00 without accessories.
MANUFACTURER'S NAME: Terris Radio Mfg. Corp.

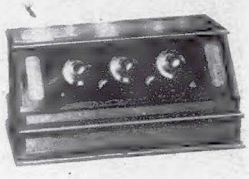


TRADE NAME: "Neutrodyne Phonograph Radio Panel."
MODEL: P-11-215.
TYPE: For Victor Console No. 215.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $115.00 without accessories.
MANUFACTURER'S NAME: R. E. Thompson Mfg. Co.
NOTE: For Victor Consoles No. 400, 405 and 410, the price is $125.

TRADE NAME: "Grandette."
MODEL: V-50.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $125.00 without accessories.
MANUFACTURER'S NAME: R. E. Thompson Mfg. Co.



TRADE NAME: "Parlor Grand."
MODEL: S-6.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $145.00 without accessories.
MANUFACTURER'S NAME: R. E. Thompson Mfg. Co.

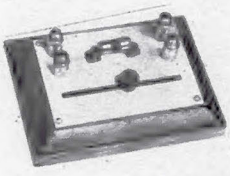


TRADE NAME: "Concert Grand."
MODEL: S-70.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: Dry cell batteries may be self-contained.
CONTROLS: Three.
AERIAL: Indoor or outdoor.
PRICE: $180.00 without accessories.
MANUFACTURER'S NAME: R. E. Thompson Mfg. Co.

TRADE NAME: Tuska Superdyne.
MODEL: 305.
TYPE: One radio, detector and two audio.
TUBES. Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $350.00 without accessories.
MANUFACTURER'S NAME: The C. D. Tuska Company.

TRADE NAME: Superdyne.
MODEL: 305.
TYPE: One radio, detector and two audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside. Loud speaker built in.
PRICE: $275.00 without accessories.
MANUFACTURER'S NAME: The C. D. Tuska Company.

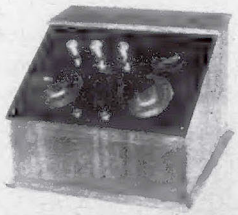
TRADE NAME: Superdyne Jr.
MODEL: 301.
TYPE: One radio, detector, one audio reflexed and one straight audio.
TUBES: Three.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $85.00 without accessories.
MANUFACTURER'S NAME: The C. D. Tuska Company.



TRADE NAME: "Van Crystal Receiver."
TYPE: Fixed crystal (no tubes or batteries required).
CONTROL: One.
AERIAL: Outdoor.
PRICE: $3.50.
MANUFACTURER'S NAME: L. D. Van Valkenburg Co.

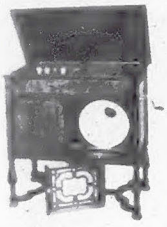
TRADE NAME: "Ware."
MODEL: W.
TYPE: Neutrodyne.
TUBES: Five 201A type.
BATTERIES: "A" 6-volt storage; "B" 90 volts.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $175.00 without accessories.
MANUFACTURER'S NAME: Ware Radio Mfg. Company.

TRADE NAME: "Ware."
MODEL: WU.
TYPE: Neutrodyne with built-in loud speaker.
TUBES: Five 201A type.
BATTERIES: "A" 6-volt storage; "B" 90 volts.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $300 without accessories.
MANUFACTURER'S NAME: Ware Radio Mfg. Company.

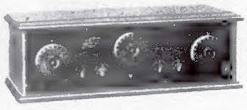


TRADE NAME: Ware Neutrodyne Receiver.
MODEL: T.
TYPE: Neutrodyne reflex.
TUBES: Three U.V. 199's.
BATTERIES: May be contained in cabinet.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $65 without accessories.
MANUFACTURER'S NAME: Ware Radio Corporation.

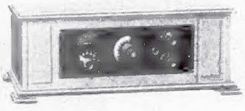
TRADE NAME: Ware Neutrodyne Receiver.
MODEL: TU.
TYPE: Neutrodyne reflex with built-in loud speaker.
TUBES: Three UV-199.
BATTERIES: Place in cabinet.
AERIAL: Outdoor.
CONTROLS: Two.
PRICE: $150 without accessories.
MANUFACTURER'S NAME: Ware Radio Corporation.



TRADE NAME: "Emerson."
MODEL: Verdi combined phonograph and Powered Neutrodyne.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $150.00 without accessories; for phonograph and radio.
MANUFACTURER'S NAME: Washmuth-Goodrich Company.

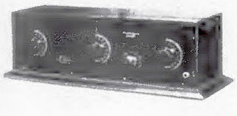


TRADE NAME: Wells Receiver.
MODEL: 23.
TYPE: Two radio, detector and two audio.
TUBES: Five.
BATTERIES: None furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $90.00 without accessories.
MANUFACTURER'S NAME: Wells Manufacturing Company.

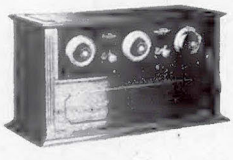


TRADE NAME: Wells Receiver.
MODEL: 24.
TYPE: One radio, detector and two audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $70.00 without accessories.
MANUFACTURER'S NAME: Wells manufacturing Co.

TRADE NAME: Wells Receiver.
MODEL: 25.
TYPE: One radio, detector and two audio.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outside or inside.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: Wells Manufacturing Co.



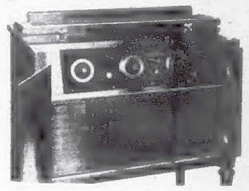
TRADE NAME: "Radiodyne."
MODEL: W. C.-14-A.
TYPE: Two radio, detector and two audio.
TUBES: Four 201-A type.
BATTERIES: 6-volt storage "A," 90-volt "B."
CONTROLS: Three.
AERIAL: Outside.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: Western Coil and Electrical Company.



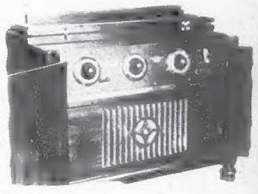
TRADE NAME: "Radiodyne."
MODEL: W. C.-12-B.
TYPE: Two radio, detector and three audio.
TUBES: Six.
BATTERIES: "A," "B" and "C" needed.
CONTROLS: Three.
AERIAL: Inside, outside or lamp socket.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: Western, Coil and Electrical Company.

TRADE NAME: "Radiodyne."
MODEL: W. C.-11-B.
TYPE: Three-stage radio, detector and two audio.
TUBES: Six.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $150.00 without accessories.
MANUFACTURER'S NAME: Western Coil and Electrical Company.

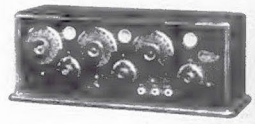
TRADE NAME: "Radiodyne."
MODEL: W. C.-12.
TYPE: Two radio, detector and three audio, built-in loud speaker.
TUBES: Six UV-199.
BATTERIES: Dry cell "A" and "B.".
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $250.00 without accessories.
MANUFACTURER'S NAME: Western Coil and Electrical Company.



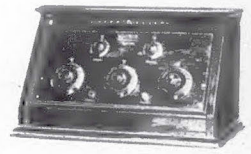
TRADE NAME: "Radiodyne."
MODEL: W. C.-11 Consolette.
TYPE: Three radio, detector and two audio, with built-in loud speaker.
TUBES: Six UV-201A.
BATTERIES: 6-volt storage "A," 90-volt "B."
CONTROLS: Three.
AERIAL: Inside, outside or lamp socket.
PRICE: $250.00 without accessories.
MANUFACTURER'S NAME: Western Coil and Electrical Company.



TRADE NAME: "Combidyne."
TYPE: One stage of radio frequency amplification, detector and two stages of audio frequency amplification.
TUBES: Four.
BATTERIES: Not furnished.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $75.00 without accessories.
MANUFACTURER'S NAME: Wolverine Radio Company.

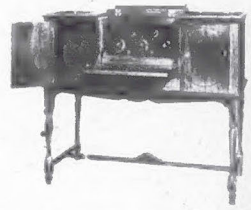


TRADE NAME: "Workrite."
MODEL: Airmaster.
TYPE: Neutrodyne.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIALS: Inside or outside.
PRICE: $120.00 without accessories.
MANUFACTURER'S NAME: Workrite Mfg. Company.



TRADE NAME: "Workrite Chum."
TYPE: Reflexed Neutrodyne.
TUBES: Three UV-199.
BATTERIES: Compartment in cabinet for "A" and "B" batteries.
CONTROLS: Two.
AERIAL: Inside or outside.
PRICE: $65.00 without accessories.
MANUFACTURER'S NAME: Workrite Mfg. Company.

TRADE NAME: "Workrite Aristocrat."
TYPE: Neutrodyne with built-in loud speaker.
TUBES: Five.
BATTERIES: Compartment in cabinet for "A" and "B" batteries.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $350.00 without accessories, but with loud speaker.
MANUFACTURER'S NAME: Workrite Mfg. Company.



TRADE NAME: "Workrite."
MODEL: Radio King.
TYPE: Neutrodyne with built-in loud speaker.
TUBES: Five.
BATTERIES: "A" and "B" needed.
CONTROLS: Three.
AERIAL: Inside or outside.
PRICE: $180.00 without accessories.
MANUFACTURER'S NAME: Workrite Mfg. Company.

TRADE NAME: Wright.
MODEL: 5A.
TYPE: Tuned radio frequency, detector and audio frequency.
TUBES: Five.
BATTERIES: "A," "B" and "C" furnished.
CONTROLS: Three.
AERIAL: Outside or inside.
PRICE: $160.00 including tubes and batteries.
MANUFACTURER'S NAME: H. Earle Wright.

TRADE NAME: Zenith.
MODEL: Three R.
TYPE: Regenerative detector and three audio frequency.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
LOOP: Outdoor or indoor.
PRICE: $160.00 without accessories.
MANUFACTURER'S NAME: Zenith Radio Corp.

TRADE NAME: Zenith.
MODEL: Super 8.
TYPE: Two stages tuned radio frequency, detector and three audio.
TUBES: Six.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $250.00 without accessories.
MANUFACTURER'S NAME: Zenith Radio Corp.

TRADE NAME: Zenith.
MODEL: Four R.
TYPE: Regenerative detector and three audio frequency.
TUBES: Four.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Outdoor.
PRICE: $95.00 without accessories.
MANUFACTURER'S NAME: Zenith Radio Corp.

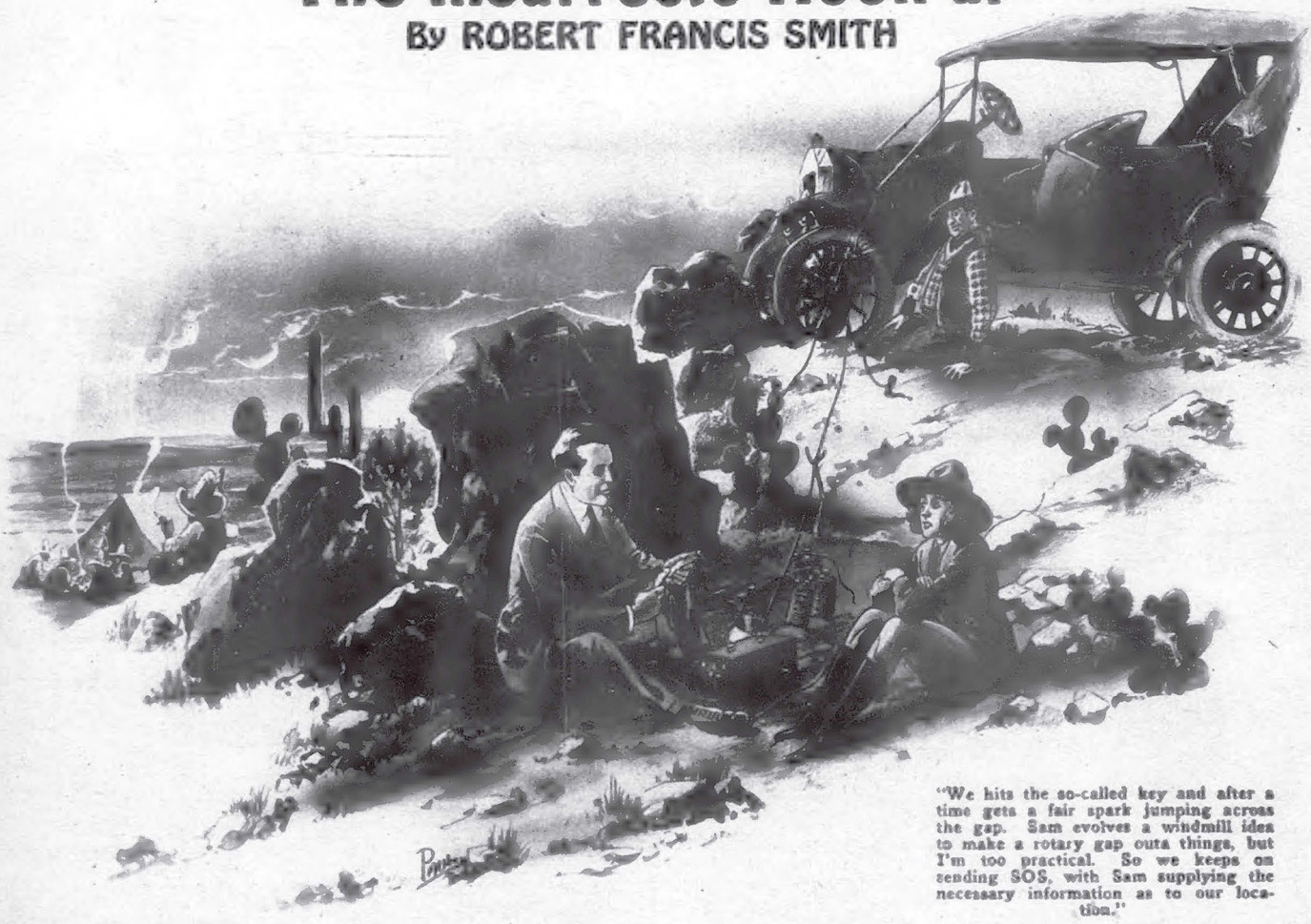
TRADE NAME: Zenith.
MODEL: Super 9.
TYPE: Built-in loud speaker.
TUBES: Six.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $350.00 without accessories.
MANUFACTURER'S NAME: Zenith Radio Corp.

TRADE NAME: Zenith.
MODEL: Super 7.
TYPE: Two stages tuned radio frequency, detector and 3 audio.
TUBES: Six.
BATTERIES: None furnished.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $230.00 without accessories.
MANUFACTURER'S NAME: Zenith Radio Corp.

TRADE NAME: Zenith.
MODEL: Super 10.
TYPE: Built-in loud speaker and battery eliminator.
TUBES: Six.
BATTERIES: House current employed.
CONTROLS: Two.
AERIAL: Indoor or outdoor.
PRICE: $550.00.
MANUFACTURER'S NAME: Zenith Radio Corp.

The Insurrecto Hook-up

By ROBERT FRANCIS SMITH



"We hits the so-called key and after a time gets a fair spark jumping across the gap. Sam evolves a windmill idea to make a rotary gap outa things, but I'm too practical. So we keeps on sending SOS, with Sam supplying the necessary information as to our location."

RADIO?" drawls Sagebrush Sam. "Me? Stranger, I introduced that form o' communication into these parts night onto ten years ago."

How come?" I asks.

Well, sir, it 'uz this way. You see, I'd quit the cattle game temporarily and gone into the business o' raisin' chickens and aigs. Had a couple square miles o' waste land a little ways out o' Santa Fe and used to let the chickens run wild. Then, when night'd come, half o' 'em 'ud forget to come home, or got lost, or somethin', leastwise, there wasn't no excess profits in it. I couldn't call loud enough for all o' 'em to hear me, so I built a small wireless outfit and several o' these loud speakers. They 'uz crude, but

(*Continued on page* 1763)

When Buying Vacuum Tubes

By VERNON C. MACNABB

The purpose of this article is not to present a long technical discussion as to the characteristics of tubes, but to point out a few visible means which a layman has of telling a good from a bad one.

DUE to the fact that the third and last structural patent on vacuum tubes terminated in February, 1925, and became public property, it is only natural that a large number of companies and even individuals are already experimenting, making and offering tubes for sale. These tubes are generally known as "bootleg" tubes. This term is probably a little harsh and should apply only to those manufacturers who make tubes and place on them the R.C.A. or G.E. label or trademark. The term "independent" is probably more representative of the companies who

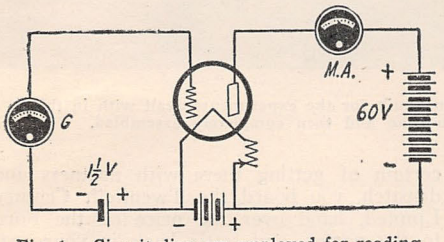


Fig. 1. Circuit diagram employed for reading, by the meters, the amount of gas within a vacuum tube.

make tubes and sell them under their own names.

To the layman (except a few so-called "experts"), the elements of a tube and its characteristics are somewhat of a mystery. So when a man goes into a store to buy a tube, he has the choice of a tube with the name of a large corporation behind it at one price, or he can buy a tube he has never heard of before at a lower price. The only advice he has to follow is the word of the salesman which he often has occasion to doubt.

Since the independent tube industry has been limited mostly to the 201A type and to a lesser amount to the 199 type, these two tubes will be the ones most fully discussed.

The first discussion will be a refutation of some of the foolish ideas people have about tubes. Most everyone in buying a tube will look at its outside appearance to see that the tip is not broken (if it is a tipped tube) and to see if the contact pins are O. K. This is simply a mechanical inspection and defects are readily visible to anyone.

ERRONEOUS IDEAS CONCERNING TUBES

During this examination the dealer is often up against some "trick" questions. Dealers have often had people refuse to buy a 201A or 199 type tube because it wasn't "silvered" all over. The "silver" is not there by way of decoration, but is there for a far more important reason. To begin with, it is not silver, but is just plain magnesium such as is used in taking flashlight pictures. A small piece, about ⅛-inch square, is attached to the plate of the tube while under construction, and after the tube has been exhausted of air as completely as possible, the plate is made red hot by high frequency induction, and this small piece of magnesium then vaporizes. (It cannot burn, because there is no air in the tube.) In vaporizing, this magnesium combines with the few molecules of gas left in the tube after the exhausting process and condenses on the cold glass of the bulb. Whether this magnesium deposits evenly or not does not affect the completeness with which the gas is cleaned up. So if any reader has an idea that a totally coated bulb is better than one only half coated, he is laboring under a false impression and should get rid of it.

The style of the plate, whether it is plain or has ridges in it, has no effect on the operation of the tube. These ridges are simply to give it mechanical strength during the process of mounting and are merely manufacturing details.

There have also been some current rumors that a tipless tube is not as good as a tipped tube, because it cannot be exhausted as well, but this is also a mistaken idea. The only limitation to high evacuation is the vacuum pump, which is the same for both tipped and tipless.

Test sets are gradually coming into universal use throughout the better retail tube dealers. Their correct use is highly recommended, but unfortunately, in many cases, their use is not understood, or if it is, dealers will not take the trouble to use them properly. It might be well to mention some of the values of a tube that should be determined together with methods for obtaining them.

YOUR CAR!

Are you interested in motoring, touring or camping? If you are, do not fail to read the March issue of

MOTOR CAMPER AND TOURIST

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By E. L. Chicanot
When March Winds Blow
By Mrs. A. Sherman Hitchcock
Flivvered Water
By Thomas Thursday
Winter Camping
By Corporal Boyles
Camp Life on the Down Gulf Trails
By Wm. Gilbert Irwin

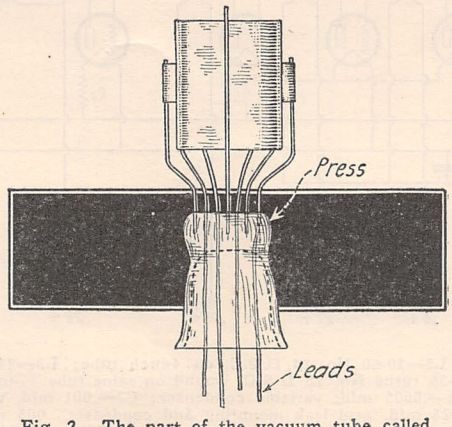


Fig. 2. The part of the vacuum tube called the "press" through which all the leads are taken.

THE GAS TEST

One important measurement that should be made by the manufacturer is the amount of gas left in a tube. This is done by measuring the electric current carried by the positive ions flowing in the tube; these positive ions are formed from the gas molecules. The diagram of connections for reading gas is illustrated in Fig. 1. The grid is made negative with respect to the filament and it attracts the positive gas ions, the current carried by these ions being read on meter G. (Notice that in this diagram the grid return is connected to the negative filament. This is very important, for if the

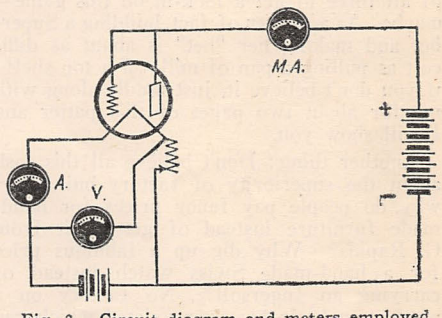


Fig. 3. Circuit diagram and meters employed for measuring the filament emission of a vacuum tube.

grid return is connected to the positive filament, the effect of the 1½-volt "C" battery will be neutralized.) This gas current is never read by the dealer and has no particular importance to the buyer, for once the gas is removed from a tube, it will not increase unless the glass cracks or air leaks in through the press along the leads. The "press" is the part of the tube through which the wire leads are brought out from the filament, plate and grid as illustrated in Fig. 2. The glass is melted and pressed around the leads at this point, making an air-tight joint. As great a quantity of air as would leak in through a crack or along the leads through the press would show up as a blue glow when the filament is lighted and voltage put on the plate. A still larger amount of air in a tube would be indicated by the filament not lighting or else glowing only a dull red. (WD 11's and 12's have a different type of filament and under normal conditions light only to a dull red.)

SOFT OR GASSY TUBES

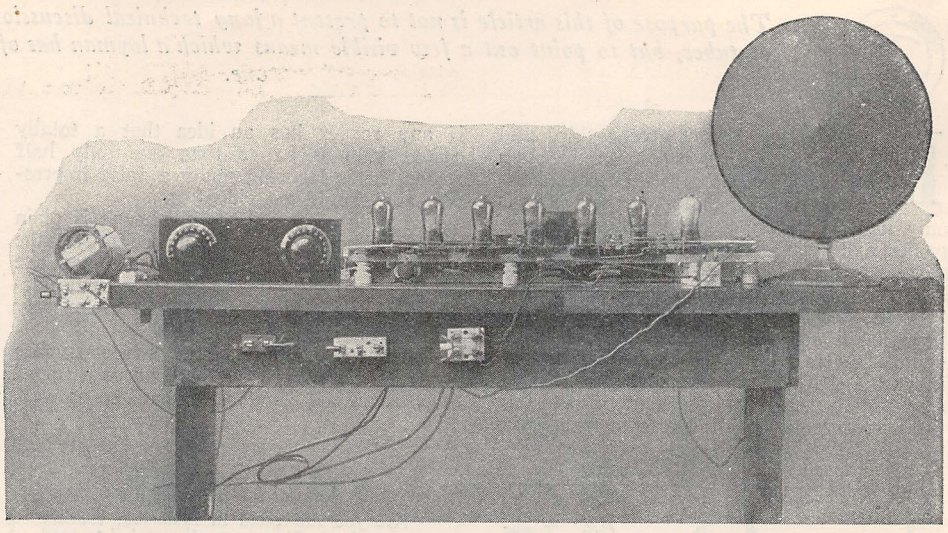
The so-called soft tubes, as the 200, are exhausted and then a small quantity of inert gas—argon being the most commonly used—is allowed to enter. This makes a soft or gassy tube. Many people have noticed that after a period of use, these tubes do not act as soft tubes. One of the most common ideas is that the gas is driven out through the glass when the tube gets hot and cannot re-enter when the glass cools. This idea may be a result of pre-broadcast days when the old DeForest tubes were used by amateurs. In those days the hams would heat the tube in an oven to make it soft. This is due to the fact that glass is able to absorb a small quantity of gas and some of the gas that was purposely placed in the tube to make it soft is absorbed by the glass. Heating the bulb drives this gas out and makes the tube temporarily soft again.

(*Continued on page* 1750)

Some Super-Heterodyne Notes

By WILFRED TAYLOR

MR. TAYLOR regales the builders of Super-Heterodynes and teaches them efficiency, in this article. He does it entertainingly, too.



Above is a view of the completed Super-Heterodyne built for the experiments dealt with in this article. It was constructed a unit at a time and then completely assembled.

I HATE to think how many tons of perfectly good newsprint have been gummed up with more or less informative articles on the fearsome Super-Heterodyne circuit, but here goes another—which I hope will be a bit different from its predecessors. Most hardy souls approach the cantankerous critter on its blind side, gentle it a bit with strange incantations and then try to mount—with more or less success; you have to be a Graduate Engineer, a Radiotrician, an R. E., or a combination of all three to get a look-in on this game—maybe. As a matter of fact, building a Super-het and making her "het" is about as difficult as pulling a pan of milk off a top shelf; if you don't believe it, just toddle along with me for about two pages of this patter and I will show you.

Another thing: Don't believe all this tosh about the superiority of factory built sets; why do people pay fancy prices for hand-made furniture instead of getting it from G. Rapids? Why dig up a fabulous price for a hand-made Swiss watch instead of carrying an Ingersoll? No factory on a production basis has ever existed which can begin to compete with the dexterous hands of a skilled mechanic.

THE SUPER-HET CLASS

If you are to be in the Super-Heterodyne class, you must have a "laboratory"; I have one—a peach; it consists of an old kitchen table and about four instruments of precision I got at a hardware store around the corner.

Having acquired a laboratory, you install it over behind the kitchen sink, so the missus and the kids won't be apt to molest it, and so you will be near a cold water pipe. Then you will fill the old dudeen, put your feet on the mantelpiece and, having the aforesaid cutty drawing well, commune with yourself thusly: "Now just what do I expect of a radio receiver? Do I want a bit of Chippendale, or do I want radio? Is WBZ good enough for me, or shall I reach out into the silences of the night and bring in the whispering voices of far countries? I don't know a blamed thing about radio, but it seems to me that, when the novelty wears off, I will get good and tired of WBZ; ergo, I will build a receiver which will get WBZ *and* which will be so darned sensitive that I will be able to hear the flies crawling on the Gatun Locks!" Just so; your decision will simplify matters a lot. A radio receiver is just like a pair of shoes—you wouldn't buy a pair of dancing pumps to go duck hunting with; don't try to build *Louis Quinze* furniture, or a lunch box set, and expect to get much in the way of faint signals.

A QUESTION

Just about here a horrid thought disturbs your crystal-clear thinking: Bill Jones has a three-tube "calamityplex" (smouched from McLaughlin) with which he brings in the West Coast three nights a week; yea—he brings in the West Coast, it is true, but if he gets through the static, code and *interfering stations* once or twice in a season, he sure has done something to write home about. You may hop into a Ford and start for Chicago; you will get there (some time) provide you don't hit a washout or a blizzard; but if you wish to be reasonably certain of getting there with neatness and dispatch, you board the Twentieth Century Limited, hand over the price of the Ford to the porter, and settle back in your seat to enjoy the scenery *en route*. The three-tuber will get you to Chicago, weather permitting, but your arrival will be all mussed up and distorted; the multi-tube set, particularly the Super-Heterodyne, will get you there serene and refreshed, with a volume and clarity of tone in a class all by itself. We will build one of these three-tubers right now, and later you will see the difference yourself. And when some lad tells you a husky tale about tuning in China, don't doubt his word—perhaps he did—but run a buzzer audibility test on his set before accepting his implied assertion that he has the most sensitive receiver on the map—he may have—and then again he may have had a bit of common freak reception with a set not sensitive enough normally to get a station in the next county.

THE ANTENNA

If you have that rare commodity, a yard, you will proceed to take stock of the possibilities for erecting an antenna. Right here I wish to state that your final results will be directly proportional to the care with which you put up this bit of clothes line.

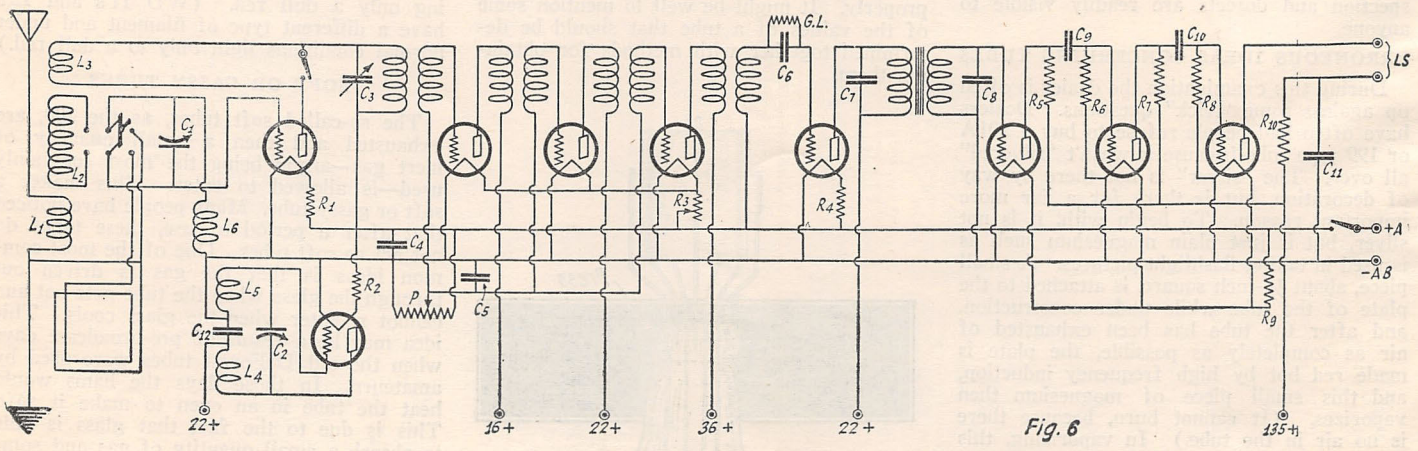


Fig. 6

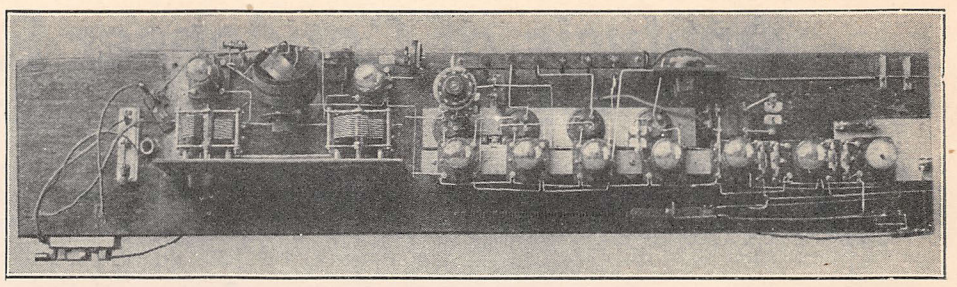
L1—15 turns No. 14 D.C.C. on 3-inch tube; L2—50-60 No. 14 D.C.C. on 4-inch tube; L3—24 turns No. 24 D.C.C. on 3-inch tube; L4—36 turns No. 18 D.S.C. on 3 5-8-inch tube; L5—36 turns No. 18 D.S.C. wound on same tube ½-inch apart; L6—15 turns No. 24 D.S.C. on 3-inch tube. C1—.0005 mfd. variable condenser; C2—.0005 mfd. variable condenser; C3—.001 mfd. variable condenser, mica; C4—.005 mfd. condenser; C5—.5 mfd. by-pass condenser; C6—.00025 mfd. grid leak mounting and condenser, .005 mfd. bolted to above; C7—.002 mfd. condenser; C8—.00025 mfd. condenser; C9—.006 mfd. condenser; C10—.006 mfd. condenser; C11—.5 mfd. by-pass condenser; C12—.005 mfd. condenser; R1, 2, 4—20- to 30-ohm fixed resistances; R3—6-ohm rheostat; R5—.25-megohm resistance; R6—.5-megohm resistance; R7—.1-megohm resistance; R8—.1-megohm resistance; R9—¾ amperite; R10—.005-megohm resistance. P—400-ohm potentiometer.

Get hold of any one of a dozen articles on this subject which have appeared in RADIO NEWS and follow directions implicitly. Use *solid* copper wire, No. 14 or larger, insulated (unless you wish to polish the oxide off it once a week), using any length you can get into the space available; keep it away from trees and at least 10 feet above housetops; get it as high above the ground as you can and use glass or glazed porcelain insulators. Spend time and such funds as are necessary to make this a work of art! Then get a fussy streak and hook up to that cold water pipe for a ground—and be more than usually fussy, because a first class ground is of the utmost importance.

If you decide that a loop may be useful at times, install a double pole double throw switch where the antenna comes to your table, fasten the terminals of one end to the proper ends of your secondary coil, the other end terminals to the loop and the middle ones to the tuning condenser, then put a husky single pole single throw switch across the tickler leads so the tickler may be shorted out when you use the loop, and you will be all set for either. This arrangement is shown in the circuit diagram at Fig. 6. I have bought or made every conceivable kind of loop and find that four turns of 16-strand lamp cord (single cord) on a six-foot box frame is as good, or better, than any. Ground the filament end of the loop and it will lose its directional effect and be much more sensitive; if you get rid of its directional effect, you will avoid the necessity of swinging it all over the room in order to get different stations in different directions. A small, pivoted loop helps to tune out unwanted stations—if these stations are in another direction than the one you want (which they never are), otherwise it is an unmitigated nuisance.

If you are perfectly certain that your antenna and ground, or loop, are as good as time, money and patience can make them, we will proceed to build the best two circuit tuner that we can devise.

This is a "laboratory instrument," remember, so we will dispense with all pretenses to "looks," efficiency being our middle name. Procure a piece of panel about 5 or 6 by 14 inches; screw a ⅞-inch square wood strip to the bottom of this panel, and to each end attach a .0005 mfd. variable low loss condenser with vernier dials. Screw this strip holding the panel to the table top about five inches from the front edge and a foot from the left end (see Fig. 1). Six inches back from the panel and to the rear of the right-hand condenser screw any standard bakelite socket; fasten a 20-ohm rheostat to the right of this socket, close to it, by means of a small brass anglebrace or a strip of panel arranged the same as the condenser panel.



Above is a top view of the completed instrument containing the tester and matched parts described. Note the location of the components and their relation to each other.

Take plenty of time and make yourself a coil as follows: Saw three rings ½ inch wide from a 4-inch hard rubber tube; saw six strips of hard rubber ½-inch wide and 8 inches long; fasten these strips to the rings by means of 6/32 machine screws and nuts—the middle ring need not be fastened, as the wire pressure will hold it in place (see Fig. 2). On this frame wind 60 turns of No. 14 D.C.C. wire, winding the wire *double,* that is, two strands at a time. Solder

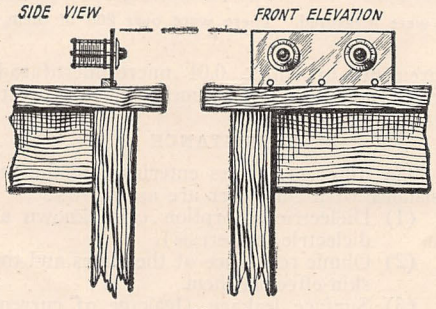


Fig. 1

The peculiar method of mounting the various parts on the experimenter's table is shown above.

both ends to the screws used to fasten the strips to the rings; remove *one* wire; this should give you a single wire coil, wound practically on air with a good sized air space between turns. There will be no shorted turns and little capacity.

For a primary, wind 10 turns of No. 14 D.C.C. on a piece of 3-inch tubing and swing this in one end of the large coil; use a lolly-pop stick for an axis, if nothing else more pretentious is handy. For a tickler, wind 24 turns of No. 24 D.C.C. wire on another piece of 2½-inch tubing and swing this in the other end of the large coil. All this will take time, but it is time well spent; you can't buy a coil at any price, which will prove as good.

Having completed the coil, hook it up with socket and right-hand condenser as per the diagram of Fig. 3; connect any kind of audio amplifier you have around the place, and I will wager you never saw a better three-tuber in your life.

This circuit is the *sine qua non* of the Super-Heterodyne. If it is extra good, your Super will be extra good, and if it is poor, you might as well spare the expense of a radio frequency amplifier. Build the receiver with the utmost care; scrape every contact clean, so it shines all over; do *not* use lugs—use the nipple-nosed pliers shown in the photo; do not use any more solder than is absolutely necessary—none at all where a good mechanical contact can be maintained. If you wish to make a permanent job, and you are not a dyed-in-the-wool radio bug, if you don't change the whole works within a week, put a drop of solder on top of the nut after it is drawn tight so that it will not work loose (a faintly possible contingency); use No. 14 tinned (not plated) *round* bus wire and make the bends with your fingers so that the bends are *curves* and not angles (see Fig. 4). The grid leak and condenser should be mounted on the socket and the necessary wire run from the grid condenser to the tuning condenser, not vice versa.

The secret of a good receiver is low loss, low resistance; you get them by clean metal-to-metal contacts, wire of ample size, air as a dielectric—and the best instruments you can get.

Hook up the filament battery, run 22 volts "B" to the detector and 45 to the amplifier, put in 201A's throughout, and see what happens. Play with this circuit for two or three nights until you find out how it behaves and until you find where some of the stations come in on the dial; keep a dial record. Add or take off turns from the secondary winding of the coil until KSD comes in at 95 on the dial; the range of the set is then established.

By this time you will have become acquainted with the performance of a standard three-tube double circuit regenerative receiver; now we will make a Super-Heterodyne of it, and you will be able to judge for yourself as to its merits. A large slice of grandmother's pumpkin pie is worth nine million Emerson dissertations upon it!

You have the most sensitive detecting arrangement you can get, and you have made the signals louder by using an audio amplifier, but there are faint stations in the background that you can just hear, but are not able to bring in distinctly. You cannot add any more audio frequency amplification without making so much noise that you cannot distinguish anything, so you look about for some other means of bringing in these faint signals. If you intensify the signal before it hits the detector, you will be all set; this can be done in several ways, the

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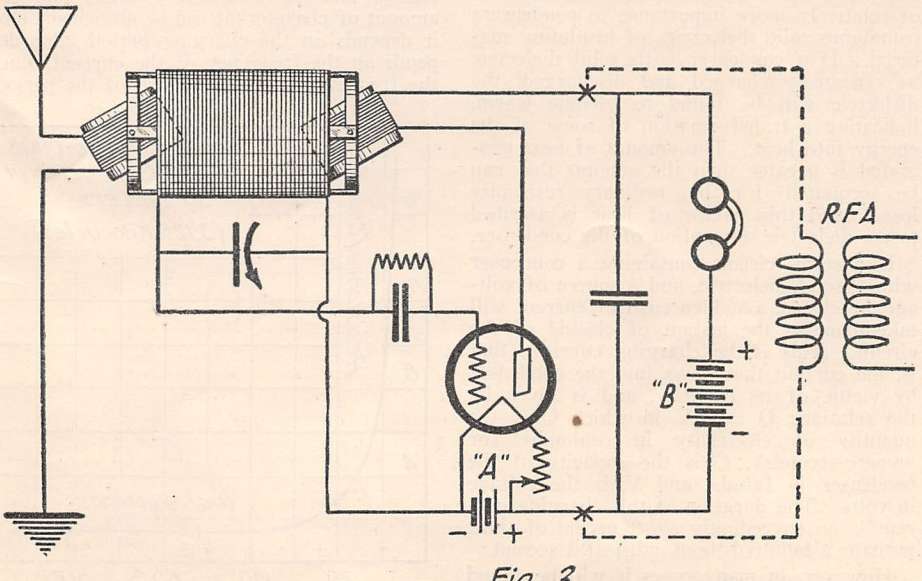

Fig. 3

The first step in the construction of the Super-Heterodyne is the assembly of the oscillator. The one illustrated above is the old familiar regeneration receiver before it is connected to the intermediate frequency amplifiers.

Analysis of Condenser Resistance

By SYLVAN HARRIS, Consulting Engineer

The word resistance when referred to condensers covers a multitude of sins. Losses in condensers can be attributed to a number of causes, with all of which the average person is not acquainted. Mr. Harris has covered the whole subject and presents it in a most comprehensive form.

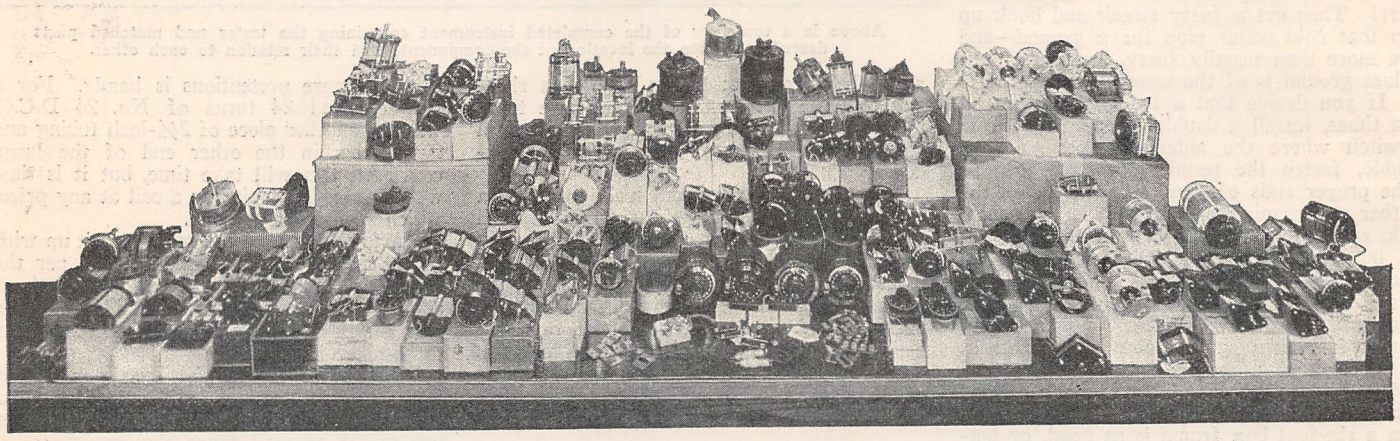

Photo showing the condensers that were measured. There were over 200 of them, made by 60 different manufacturers.

IF one were to pick up a copy of any radio periodical and scan the advertisements of condenser manufacturers scattered through it, certain interesting things would come to his notice. Being consistent with the subject of this article we may note the following list, taken from some of these advertisements:

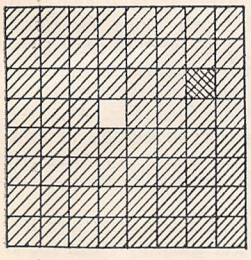

Fig. 1. Illustrating the unequal distribution of a radio frequency current in an uneven conductor.

Manufacturer	Minimum Capacity mmf.	Phase Angle Difference	Equivalent Resistance
A	14.64	(1,000 cycles)	80
B	12.20	(1,000 cycles)	670
B	14.03	(1,000 cycles)	360
B	15.25	(1,000 cycles)	55
C	14.03	(1,000 cycles)	110
D	10.37	(1,000 cycles)	40
E	.....	Too low to measure	...
F	.....	Minimum loss	...
G	12	(300 meters) 14 sec.	0.02
H			
I	.....	(300 meters) no losses	...

and so on. On studying this list there are several questions brought to mind, more especially with regard to the resistances and phase differences. In the first place most of the measurements of phase difference and resistance are made at 1,000 cycles, a frequency which is not used in radio, except for special purposes; at least, this low frequency is not used in circuits carrying the oscillatory currents. The list is incomplete as regards resistances and phase differences at 300 meters and other radio frequencies. The general view of the situation that one acquires from studying the advertisements is that each manufacturer is trying to outdo the other in quoting extremely low resistances for his condenser.

As regards the minimum capacities noted, there is one thing in particular which we would like to call to the attention of the reader. The fact that some of them are given to the second decimal place implies that the experimenter who measured them has confidence in the precision of his measurements to within 0.01 micro-microfarad. Such precision is extremely difficult to attain.

RESISTANCE

The different factors entering into the resistance of a condenser are as follows:

(1) Dielectric absorption (also known as dielectric hysteresis).
(2) Ohmic resistance of the plates and the skin-effect in them.
(3) Surface leakage (leakage of current across the surface of the dielectric).
(4) Volume leakage (leakage through the body of the dielectric).
(5) Resistance of surfaces in contact and soldered joints.
(6) Eddy-currents in metal end-plates and metallic structure.

These points will be considered in detail one by one, explaining the nature of each, and indicating the relative magnitude of the effects as determining the value of the total resistance of the condenser.

DIELECTRIC ABSORPTION

Although dielectric absorption is not very important in variable air condensers, it is of relatively more importance in condensers containing solid dielectrics of insulating material. If a condenser with solid dielectric be repeatedly charged and discharged, the dielectric will be found to become warm, indicating a transformation of some of the energy into heat. The amount of heat generated is greater than the amount that can be accounted for by ordinary resistance losses, and this excess of heat is ascribed to the dielectric absorption of the condenser.

If a series circuit containing a condenser with a solid dielectric, and a source of voltage, be closed, a sudden rush of current will take place at the instant of closing of the circuit. This is the charging current; that is, the current that flows into the condenser by virtue of its capacity, and is given by the relation: $Q = CV$ in which Q is the quantity of electricity in coulombs (or ampere-seconds), C is the capacity of the condenser in farads, and V is the voltage in volts. The duration of this charging current is an exceedingly short period of time, perhaps a hundred-thousandth of a second.

However, in many cases it will be found that a current continues to flow for a long time after the circuit has been closed. The value of this current bears no simple relation to the capacity and voltage, and seems to depend entirely upon the nature of the dielectric used in the condenser. This is the absorption current. Attempts have been made to account for it by assuming that the substance of the dielectric is not a homogeneous mass, and that there are tiny capacity effects between various points in it which gradually charge up, thus continuing the current flow.

Obviously this represents a loss of power, since it takes energy to charge these tiny condensers, and they are not located at positions where they will do any good. In order to account for this absorption in measurements, dielectric absorption is spoken of as an *equivalent resistance* in series with the condenser, or at least its effect can be measured as if it were a series resistance.

It is evident that the quantity of electricity which flows into an absorbing condenser is greater if the charging period is greater. Some poor condensers have been known to absorb a continually decreasing charge for several days, on a direct current charge. With alternating currents, charge and discharge take place in every cycle, and the amount of charge that can be absorbed, since it depends on the charging period, also depends on the frequency of the current, since the frequency is the reciprocal of the period.

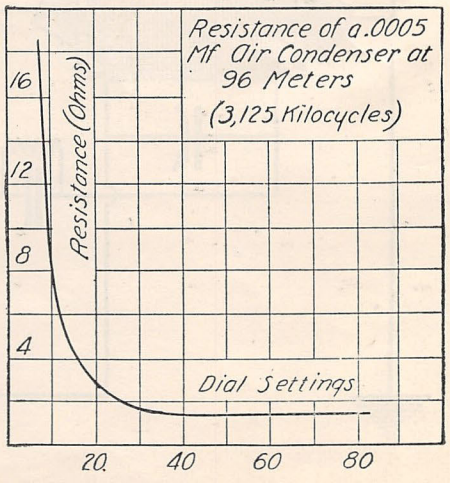

Fig. 2. A graph showing the change in the resistance of a variable condenser with a change in dial setting.

The higher the frequency the shorter the charging period, hence the smaller the absorbed charge.

REDUCING THE DIELECTRIC ABSORPTION LOSSES

The method of reducing dielectric absorption in condensers is obvious. If a solid dielectric must be used, to support the plates or for other purposes, the one chosen should have little absorption effects. In this connection it is interesting to note that when the insulating material is used directly between the plates, as in small fixed condensers, the amount of dielectric used has no effect on the absorption. Absorption may be considered in terms of the amount of energy absorbed by the dielectric per cubic inch or per cubic centimeter of the dielectric. If, then, we attempt to reduce the absorption by changing the thickness of the dielectric, we will find that it is necessary to change the area of the plates and consequently the area of the dielectric between the plates. Suppose we double the thickness of the dielectric; this would reduce the capacity of the condenser to one-half. To bring the capacity back to its former value we would have to double the area of the plates and the area of the dielectric. The result would be that we would have the same volume of dielectric. Since the energy loss per unit of volume is the same, and the volume is the same, the total dielectric loss would be the same. This is an important point in connection with fixed condensers that is not generally known. Of course, there are other considerations that affect the design of fixed condensers, which will be taken up later.

OHMIC RESISTANCE OF THE PLATES AND SKIN-EFFECT

There is no reason for anyone to doubt that the plates of condensers have ordinary resistance the same as any other conductor of electricity. If a condenser could carry direct current, this resistance could be measured simply by Ohm's law; that is, by passing a direct current through it and measuring the current and voltage. The resistance would then be $R = V/I$. This cannot be measured directly, however, since condensers will not pass direct currents. That the effect is present no one will object to. Bearing this thought in mind, we will discuss the nature of skin-effect in conductors, show how this applies to condenser plates, and, later on, show how great this effect is on the resistance of the condenser.

The ordinary resistance of a conductor may be calculated by the formula: $r = \rho \frac{l}{a}$ when the path of the current flow is known. Moreover, the distribution of current throughout the conductor must be uniform; that is, every square inch or square centimeter of the cross-section of the conductor must carry the same amount of current. In this formula (r) is the resistance of the conductor, (ρ) its resistivity or specific resistance, (l) its length, and (a) its cross-sectional area at right angles to the direction of flow of the current.

If, however, the distribution of current throughout the conductor is *not uniform*, these simple relations do not hold. This can easily be understood from the following discussion. Imagine that a cross-section of conductor, supposed square, is divided into elements of area, and that each filamentary conductor has the same resistance and carries the same fraction of the total current (Fig. 1). The equality of the currents in each filamentary conductor is indicated by the equal shading in the small squares of the figure.

Now imagine that the current in one of the filaments is removed and added to the current in another. The total current in the entire conductor is not altered, but the heat generated in the first named filament becomes zero, for it now carries no current, and that generated in the second filament becomes *four* times as great. This because the heat generated is proportional to the *square* of the current. Accordingly the total heat generation is increased, although the total current was not altered. From this it can be seen that any distribution of current in a conductor that is not symmetrical results in a resistance higher than that for a uniformly distributed current.

SKIN EFFECT AT RADIO FREQUENCIES

The next thing to be considered is, what is it that causes asymmetrical current distribution in a conductor? It occurs only under the action of alternating currents, and only becomes appreciable when the frequency of the current becomes very high, more particularly in the radio frequencies. The current is forced from the center of the conductor and is made to travel near and on the surface. In round wires of ordinary diameter at radio frequencies, the current may penetrate into the body of the conductor only as deep as, say, 0.001 mm.

The reason for it is found in the variations of the magnetic field set up by the high frequency current flowing in the conductor. The interior parts of the wire are linked by more lines of magnetic flux than are the parts nearer the surface of the wire. Hence, the self-induced voltages near the center of the wire are greater than those near the surface, and are in a direction opposed to the direction of flow of the current. Hence, the current receives greater opposition near

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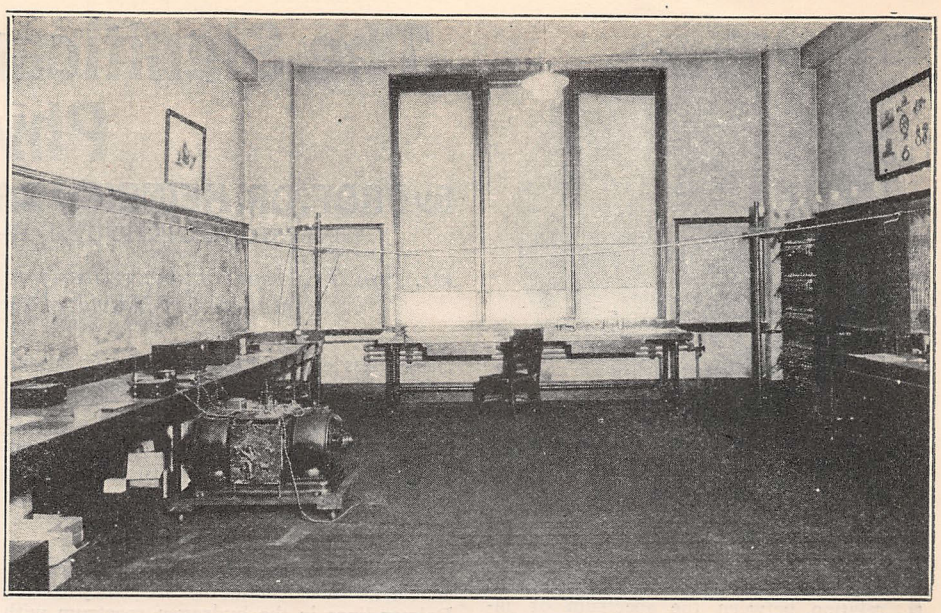

Photo of the apparatus used in measuring condenser resistance. At the far end of the table on the left are shown the instruments in the measuring circuit, which includes the condenser to be measured. The measuring circuit is tuned to the wave-length of the oscillator by sliding the movable side of the loop one way or the other.

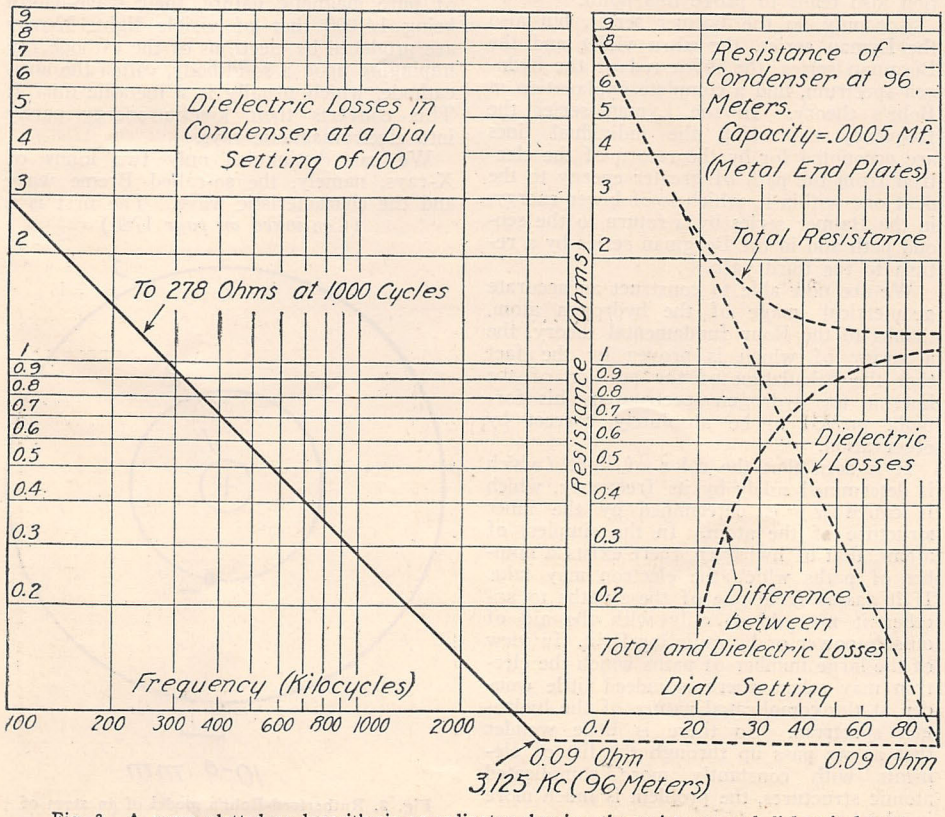

Fig. 3. A curve plotted on logarithmic co-ordinates showing the resistance and dielectric losses in a variable condenser at different settings.

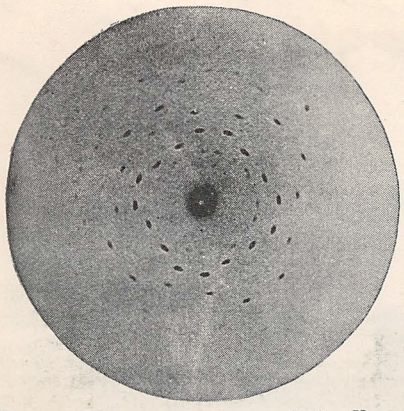

Fig. 3A. Interference image of the X-rays which is obtained when the rays pass through a crystal of rock salt. In this experiment the undulatory nature of the X-ray is shown.

The Significance of Rays In Physics

By PROF. DR. HEINRICH RAUSCH VON TRAUBENBERG
PHYSICAL INSTITUTE OF THE PRAGUE UNIVERSITY

Dr. Von Traubenberg shows clearly in this article the reason why each element produces an individual spectrum and how it is caused.

PART IV.

IN THE last article, we came to the important problem of discovering the relation between the spectrum of incandescent hydrogen and the changes in the atom which brought about the radiations giving rise to the spectrum. In the discussion of the Balmer series, as the hydrogen spectrum is called, we found that the cause of the radiation is within the atom itself.

We will attempt to follow out this unique discovery in the present paper and consider further the great discoveries of the Danish chemist, Neils Bohr. Through his very recondite and logical reasoning, we have been allowed to glimpse into the structure of the hydrogen atom with a great deal of exactitude. The fundamental steps through which Bohr arrived at his theory concerning the structure of this tiniest bit of matter is as follows:

1. The electron in the atom revolves about the nucleus in a certain fixed curve, an elipse, without losing energy by radiation in the sense of the classical physics.

2. The moment (mechanical) of such a revolving electron is an integral multiple of Planck's quantum of energy. (See Article 2). It, therefore, can have only a value of the form, nh, where h is a whole number. It follows, also, from this that the orbit of the electron is not a chance affair, but absolutely fixed—one of the so-called quantum paths.

3. The electron can change its path from one of less energy to one of greater energy only by the addition of force from the outside—from some external force.

4. In a return from one of the paths of higher energy to one of lower energy, the atom must give off energy, B, in the form of electromagnetic radiations of a frequency V=h/E.

Fig. 1. Prof. Dr. Niels Bohr seated in his study.

THE BALMER LINES

This simple hypothesis is quite sufficient to enable us to calculate the frequency of the Balmer lines in the hydrogen spectrum with the greatest accuracy. Even the constant V_0 of the Balmer formula, $V = V_0 (1/n_2 - 1/m_2)$ follows here necessarily from the otherwise known values of electron masses and their charge, as well as from Planck's constant h. Experimental observation also tends to prove this point.

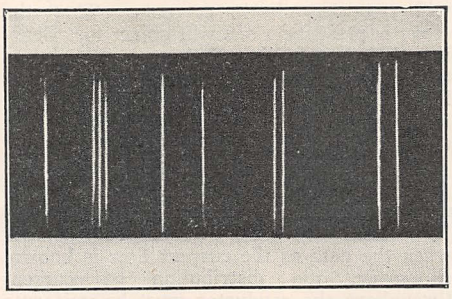

Fig. 3B. High frequency spectrum of platinum with one obtained when the X-rays reflected from a platinum anti-cathode are reflected by a crystal of rock salt. (Method of Bragg.)

Not only do the Balmer series, but also the Lyman series, the ultra violet and the Bergman series, the infra red of the hydogen spectrum, find a complete explanation in Bohr's theory. In the Lyman series the frequency expressing the individual lines are accounted for by the return of the electron from the path of greater energy to the next one within it, which is of lower energy, in the Balmer series by a return to the second path and in the Bergman series by a return to the third path.

We are now able to construct an accurate geometrical image of the hydrogen atom, thanks to the Bohr fundamental theory, the accuracy of which is proven by the fact that the calculation of the position of the lines in the hydrogen spectrum by his formula proved to be absolutely correct by observation.

It is seen that the color of light (which is determined solely by its frequency, which is called V) is determined by the inner structure of the atom. In the simplest of atoms, that of hydrogen, there exists a number of paths which the electron may take. If it passes from one of these paths to another it may do so only with the aid of outside power or by radiating light. In view of the large number of paths which the electron may select, there is indeed little wonder at the complicated nature of the hydrogen spectrum. So there is little wonder that as we pass up through the list of elements with constantly more complicated atomic structures, the problem is much more involved.

Through the study of various basic chemical and mechanical laws scientists have arrived at the theory that in the more complicated elements the electrons do not revolve around the nucleus in separate orbits, but rather group themselves in what may be called shells of energy. This notion results in a most unique corollary, *i.e.*, when the outer ring shell of energy is saturated with electrons the addition of another electron causes the element to place itself in the next higher chemical series.

It might be well to note here that, according to the chemists' classification, each element differs from the next simply by the addition or subtraction of one electron; that is, add one electron to hydrogen and helium results, and so on up through the chemical scale. Also, the chemist divides the elements into a number of groups. These groups can not be gone into here, on account of their extremely complicated nature.

GREAT DIFFICULTIES

The difficulties confronting the investigator of these periodic systems found in the spectrum are made easier through Röentgen's discovery of X-rays. This discovery was important since it enables us not only to make conjectures as to the outer ring of electrons in any element, but gives us a means of learning the properties of those series of electrons that lie beneath the surface. In the ordinary spectrum of visible light only the outer rings disclose anything to us, while with X-rays we may penetrate to the interior (Fig. 3).

The classic researches of Von Laue show that X-rays are only very short light waves of pure magnetic nature, their wave-length being 1/1000 that of visible light, X-rays are produced by electrons of the cathode ray impinging upon a solid body, called the anti-cathode, which usually is a metallic mirror. This converts their kinetic energy partly into electromagnetic rays.

We can distinguish only two kinds of X-rays, namely, the so-called Breme wave and the characteristic wave. The first is a

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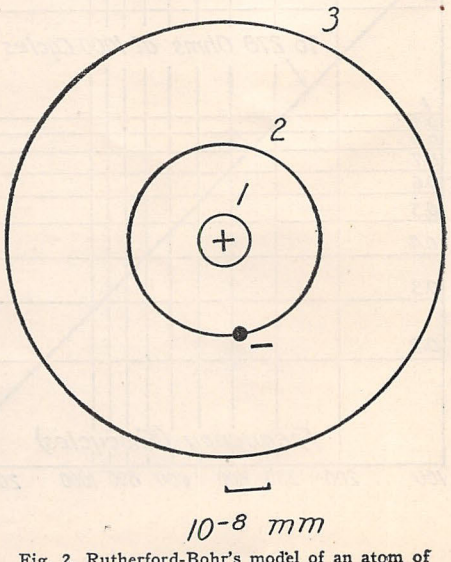


Fig. 2. Rutherford-Bohr's model of an atom of hydrogen; the electron in the drawing is shown in the second orb of rotation.

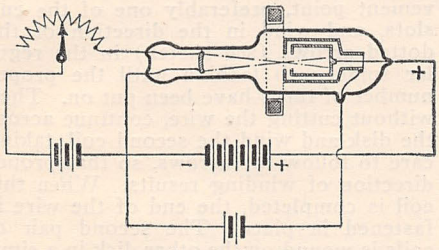
A Triode Antedating De Forest's Tube?

By D. C. WILKERSON

A bit of interesting history on the evolution of cathode ray tubes from the early Crookes tube to the Von Lieben triode. The latter, partly in principle and partly in design, parallels the present day three element tube.

THE information given in this article will come as a shock to many well informed radio fans, amateurs of long standing, manufacturers and engineers in the electrical business. We have been led to believe that the origin of the three electrode idea lay with our own Doctor Lee DeForest.

All this is more or less ancient history



Von Lieben Tube

The Von Lieben Cathode Ray Relay, and the circuit, patented on March 4, 1906, three months and twenty-two days before DeForest's three electrode tube patent.

for the average radio fan who keeps abreast of the times and reads the usual amount of radio literature. The date of Dr. DeForest's first radio tube patent is given as June 26, 1906, the patent being numbered by the Patent Office as 824,637; the next was 836,070, November 13, 1906.

Simultaneous with the work of Dr. DeForest, a group of foreign scientists were digging at the problem of the electronic relay. Wehnelt developed a series of metallic oxides which showed extreme sensitivity to heat and high cathode emission in a vacuum. Robert von Lieben, of Vienna, has been mentioned in many scientific works as an originator of novel ideas in cathode and other types of ray emitting tubes.

THE X-RAY TUBE

Let us hark back to the discoveries of Röntgen. In the early '90's, the world of science was just beginning to make headway with the so-called cathode tube, produced and modified by Crookes, J. J. Thomson and others. Dr. Röntgen, in testing the strength of the field of cathode ray influence in 1895, found that the rays produced by an ordinary cathode tube caused phosphorescence in bodies outside the tube, and that a photographic plate was affected by the rays. He succeeded in photographing a door key through a leather pocketbook by means of this ray emission, which he named X-ray.

The ordinary X-rays as they were originally produced were developed by means of an evacuated tube containing two electrodes, a cathode having a semi-spherical surface and the anode being a flat plate, the center of which was also the center of curvature of the cathode. The terminals of a high frequency source, spark coil or electrostatic machine were connected to the two terminals of the tube, the negative lead being connected to the curved surface cathode.

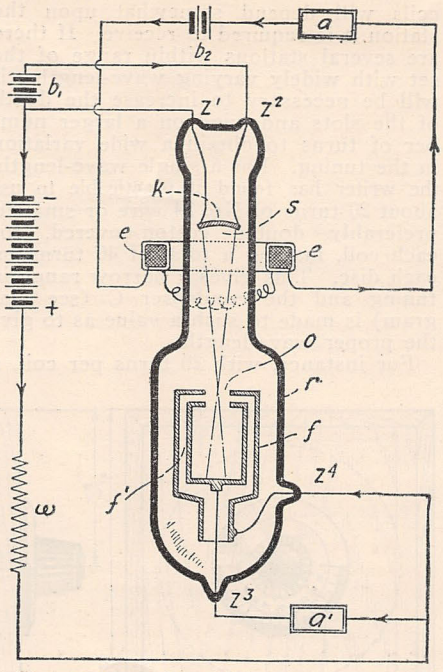
The high degree of exhaustion within the tube caused a much greater difference of interior electrode potential, and this was found to accelerate the speed of emission of the rays. In the simple cathode tube, having a comparatively gaseous content, or a vacuum of relatively low exhaustion, the speed of emission was slow, and the cathode particles being small, negative electrons moving slowly were easily deflected by magnetic or other means applied at right angles to the direction of flow.

Dr. Röntgen evacuated his tube to a high degree and the corresponding increased difference of interior electrode potential imparted a higher velocity to the cathode stream. In other words, the ordinary cathode stream gives off soft rays and the X-rays are hard. The harder these rays, the higher the degree of penetration beyond the tube. Determined by Dr. Marx as having the speed of light, they were not deflected by the application of a magnetic or electrostatic field.

THE COOLIDGE X-RAY TUBE

Our own Dr. Coolidge found that he could heat the cathode by means of a separate external circuit and that the resulting stream of negative electrons emitted could be bombarded against the anode with a sufficiently high velocity to develop X-rays. His tube, being a great improvement upon other types, because of the economy of current, universality of use, and more sure control of the various functions of the tube, has found a ready use universally since its disclosure.

He showed conclusively that the penetrating power of the rays depended on the voltage of the secondary, and that the breadth or density of the emission stream was parallel to the degree of heat emission at the cathode.

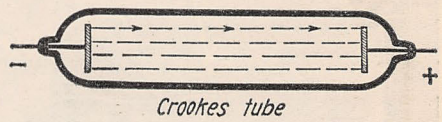


"A," "B" and "C" batteries are provided in the circuit of the Von Lieben tube, with the plus "B" connecting to the anode (plate) of the tube.

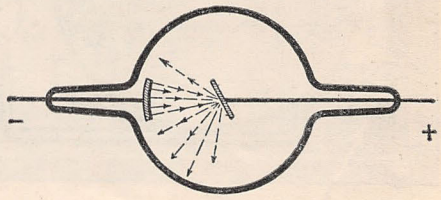
In the three electrode relay tube devised by Von Lieben, the influence of the Röntgen ideas are seen. Von Lieben, in working out a practical method to control emission, borrowed from Wehnelt the metallic oxide surface as a source of electron emission, took the curved surface of Röntgen as the proper shape for his emitter electrode, and projected the resulting electron beam through a tubular shaped grid member, the aperture of which was charged and discharged from an external circuit source electromagnetically or electrostatically.

In the original DeForest patent, both magnetic and electrostatic means for applying a third electrode current were included and in some of the DeForest cases a horseshoe-shaped magnet was wire wound and placed in such a position that its field would influence the electron flow or cathode stream in the tube.

It must be remembered that the "cathode ray" of 20 years ago, having a relatively slow electron flow, has become known as an electron stream today, and we have learned that this flow is composed of tiny electrons traveling from the heated filament to the positively charged plate, which because of the law of opposites exerts an attracting influence on the negative electrons.



Crookes tube



The original Crookes tube produced a soft ray; this produced by the cathode stream. The Roentgen tube shown below, because of its high evacuation, gave off hard rays, known today as x-rays.

At the time of the filing of the DeForest claims, and before, this truth about the character of flow was not known, and Dr. DeForest himself admitted that he could not explain the actual character of the phenomenon he had discovered and filed patent applications on.

His collector electrode was a tube.

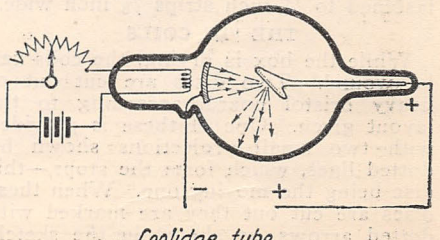
The variations from the changing charges upon the surfaces of the control electrode produced corresponding changes in the external circuit of the collector electrode just as we know of it in modern radio tubes.

THE VON LIEBEN PATENT

The patent was filed on March 4, 1906, in the German Imperial Patent Office three months, twenty-two days before DeForest's, and issued November 19, the same year, for a Cathode Ray Relay. The patent papers were received and stamped in the United States Patent Library, December 19, 1906, making them a matter of public record in the United States on that day.

The direct translation clearly states that

(*Continued on page* 1754)



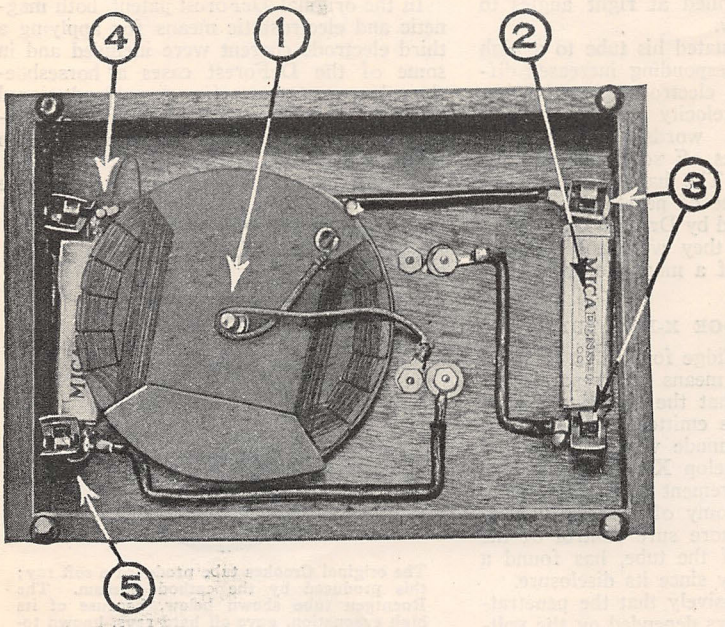
Coolidge tube

In the Coolidge tube, the cathode is heated by an external circuit, and the velocity of the negative electrons bombarding the anode so increased as to produce X-rays.

A Unique Crystal Set

By L. L. MATSON, B. E. E.

A description of an excellent little crystal receiver of unusually simple construction. The "D" coil variometer employed for tuning the set is very easily constructed. The set is designed to cover the present band of broadcast wave-lengths.



Interior view of the completed crystal set showing the simplicity of the layout and wiring. 1 is the "D" coil variometer, 2 the fixed phone condenser, 3 the phone connecting terminals and 4 and 5 the aerial and ground terminals across which is placed a fixed condenser.

THE crystal set, representing as it does minimum investment with a maximum result in clearness, is enjoying a rapidly increasing popularity, particularly in the vicinity of broadcast stations. With the present increase in the number of these stations and in the power used, it is becoming more and more useful.

The writer has built several sets such as the one described in this article, with very satisfactory results. It is neither difficult nor costly to make and is pleasingly different in appearance from the average set and it is also simple in operation.

THE CIRCUIT

As shown in the circuit diagram, the set consists of a variable inductance in the form of a variometer made up of four "D" coils wound on cardboard discs, with a fixed condenser to bring the set up to the proper wave-length, a phone condenser, and some form of crystal detector.

The first step in the building of this set is the making of a small wooden box or cabinet, consisting of a top, ⅜ x 4 x 6 inches, around which are fastened sides of ¼ inch stock 1¼ inches wide. These may be either mitered, as in the sketch, or may be simply butt-joined. The box is sanded and given a coat of shellac and is then ready for the mounting of the remaining parts. (An alternative construction at a slightly increased cost, would be to use a bakelite panel 4½ x 6½ inches, fastened to ¼ inch strips ⅞ inch wide.)

THE "D" COILS

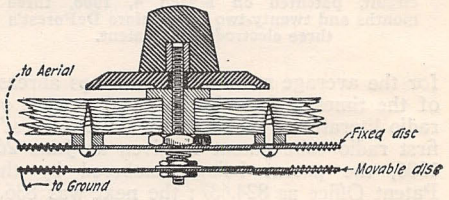
While the box is drying, the coils can be wound. Two discs are cut out of heavy bristol board, according to the layout given. One of these is provided with two small projections shown by dotted lines, which form the stops,—this disc being the moving one. When these discs are cut out they are marked with dotted arrows, as shown in the sketch. The direction of these arrows is very important as it assists in properly winding the coils.

The number of turns wound on the coils will depend somewhat upon the station it is required to receive. If there are several stations within range of the set with widely varying wave-lengths, it will be necessary to increase the depth of the slots and wind on a larger number of turns to obtain a wide variation in the tuning. For a single wave-length, the writer has found it practicable to use about 20 turns of No. 24 wire or smaller, preferably double cotton-covered, for each coil, making a total of 40 turns on each disc. This gives a narrow range in tuning and the condenser C (see diagram) is made to such a value as to give the proper wave-length.

For instance, with 20 turns per coil, a .0005 mfd. condenser will give a wave-length range of from 350 to 400 meters with the average aerial. To summarize, the number of turns per coil and the value of the condenser C, will be somewhat a matter of experiment, depending upon local conditions.

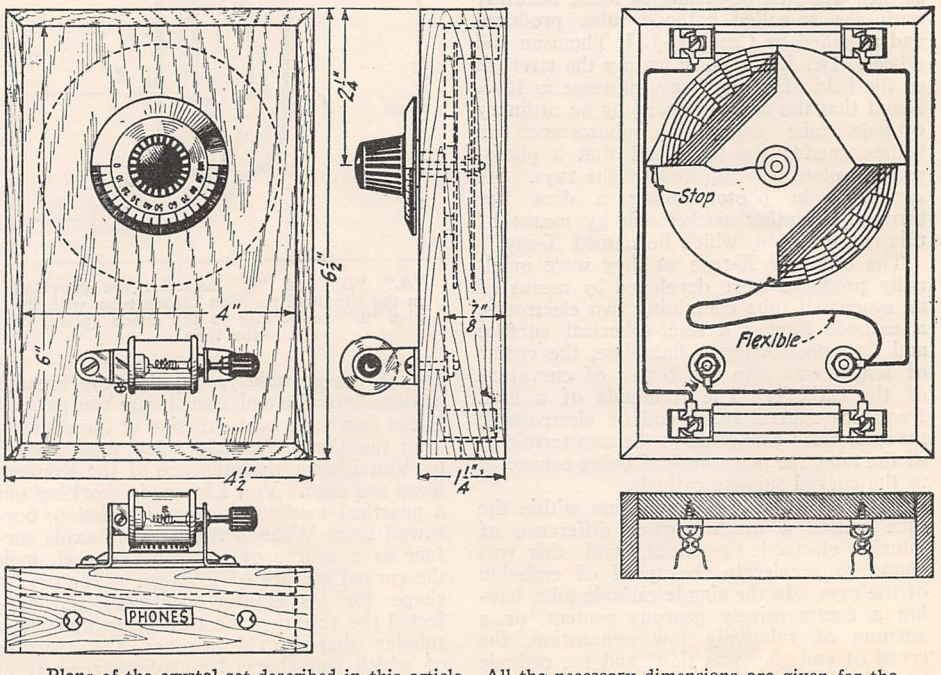
WINDING THE COILS

In winding the coils, start at any convenient point, preferably one of the end slots, and wind in the direction of the dotted arrows (see sketch) in the regular spider-web fashion until the proper number of turns have been put on. Then without cutting the wire, continue across the disk and wind the second coil, taking care to follow the arrows, so that proper direction of winding results. When this coil is completed, the end of the wire is fastened in place. The second pair of coils is wound on the other disk in a similar manner.



Showing the manner in which the "D" coil variometer is fastened to the panel and how the knob and dial is attached.

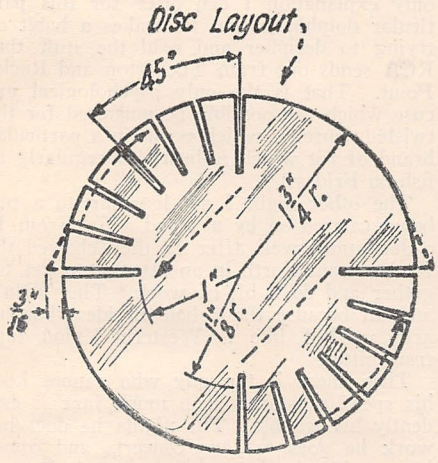
As shown in the large detail section of the sketch, the moving coil is mounted upon an ordinary switch lever. A knob and dial replace the usual knob and switch arm. This switch lever is mounted at one end of the box as indicated in the sketch. A small hole is then cut in the center of the fixed disk which is placed in position on the inside of the box, con-



Plans of the crystal set described in this article. All the necessary dimensions are given for the case and the position of the components designated.

centric with the switch lever, and fastened in place with two small wood screws, a few washers being used to hold it out from the surface of the wood. The switch lever is then inserted in the bearing and a couple of turns of the usual spring are slipped over it, after which the moving disk is mounted in place by means of two nuts. The connection between the fixed and moving coil may be made by soldering one end of the wire on each disk to small washers which are slipped over the switch lever before the spring is put in place; or a short flexible lead may simply be soldered between the two coils.

No spacing is shown for the binding posts; these are of Fahnestock type and their location will depend upon the type of fixed condensers obtained, as they are mounted directly on the condenser as



Details of the variometer forms upon which the wire is wound.

shown in the section b-b, a wood screw through the binding post and condenser holding them in place. A ¼ inch hole is then drilled through the end piece opposite each post. Terminals are pushed through the holes and clamped by the posts.

THE WIRING

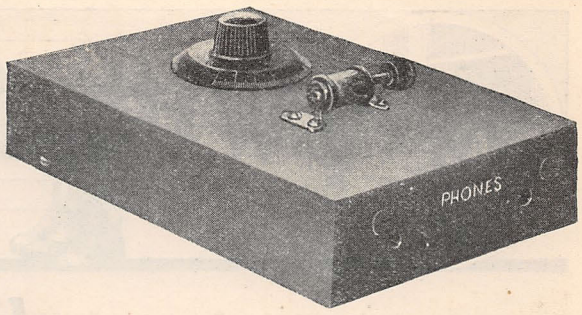
The wiring of the set is very simple. One end of one fixed coil is connected to the aerial post. Since the connection between the two discs has been made, the only remaining coil connections is that shown by the flexible lead in the under view of the set, which connects to the ground at either the detector or the ground binding post, whichever is most convenient. The additional connections from aerial to phones, phones to detector, and detector to ground should preferably be made of tinned bus wire covered with spaghetti tubing. All connections should be carefully soldered and special care should be taken to solder the binding posts to the condenser terminals rather than depending on the wood screws to hold these in contact.

The stop shown in the diagram should be so located that when the dial is at zero, coils wound in opposite directions are over each other, as this is the position of minimum inductance. By marking each disk with a positive and a negative sign, as shown on the layout, the direction of winding of any coil is easily determined.

CRYSTAL DETECTORS

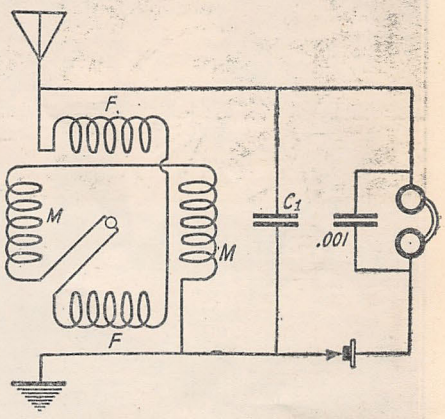
A word regarding detectors. The sketch shows one of the galena and cat whisker type which, with a good crystal, is very satisfactory. A more stable type of detector is that using two different crystals held in contact by a spring, which makes it more stable in operation. No details regarding the location of the detector are given, as this will depend upon the type available.

With this set connected to an aerial 60 to 75 feet in length, either out of doors or in the attic, or if this is not possible,



A view of the completed set. The phone terminals are inside the box; the phone tips are inserted in the two holes.

concealed behind the moulding running around three sides of the room, with a good ground connection, and with almost any type of high resistance phones, this set will be found very simple to operate and will give very satisfactory results. As to the distance one can cover with the set, this depends on the location and on the sensitiveness of the crystal.



The circuit diagram of the crystal set. Note the way the coils of the variometer are connected.

Radio Anticipations for 1925

SEVERAL of Uncle Sam's radio experts and administrators have been persuaded to predict some of the developments likely to greet us during the new year, although some of them explain that it is a very uncertain business to make any predictions concerning radio development. They say the radio art is so young in comparison with electrical engineering, of which it may be called an offshoot, that things take place so rapidly as to render most predictions little better than mere speculations.

A NAVAL RADIO ENGINEER SPEAKS

Dr. A. Hoyt Taylor, director of the Naval Radio Research Laboratory, believes himself reasonably certain of seeing considerable progress in the coming year:

"In the broadcasting field, more and more people are becoming interested broadcast listeners and a greater and greater percentage of them are of the type who will not be so much interested in picking up freak long distance stuff just for the sake of saying they have received some very remote station, as they will be in getting consistent and high-grade programs, free of interference from both natural and human sources. In other words, as in the case of the telephone, the receiver will become a standard service proposition instead of a novelty.

"Having been an ardent amateur and distance 'hound' myself for many years, I fully realize the fascination of that end of the game, but find that I have outgrown that stage and when I listen in on my own receiver at home, I like to get a program that comes through clearly, distinctly and steady in volume so that I am not obliged to make adjustments to the last agony of accuracy, or to strain my ears to catch the more complicated parts of the program through interference from various sources. Just as consistent and reliable communication is the keynote of service in telegraphy and telephony, so will they become the keynote of service ultimately in the broadcast field.

"I remember the first time I ever listened to a trans-Atlantic station, I was very much pleased with myself and with my receiver. I have copied distant stations in New Zealand under conditions that caused me to take considerable pride in the achievement, but I believe the average user of broadcast apparatus is ultimately going to demand the same standard of reliable service that he gets in the telegraph and telephone. Therefore, I am in favor of high-power broadcast stations although, on account of the persistency of fading effects, I do not think this is going to materially increase the ranges of these stations. It will merely give a more reliable and definite program over a range of, say, 100 miles. The trend of broadcast receivers is something that interests me a good deal. I do not believe in a cheap receiver. All channels in the ether which are possible for radio communication will be needed—most of them are already needed.

"No one has a right to throttle the art and demand that conditions be arranged so that he can receive out-of-town stations through local interference. I would like to point out also that the use of high-power broadcast stations will not increase interference if the plan is properly carried out, as these stations will be located away from congested centers and will not be as troublesome as the present high powered stations which are located right in the hearts of some great cities.

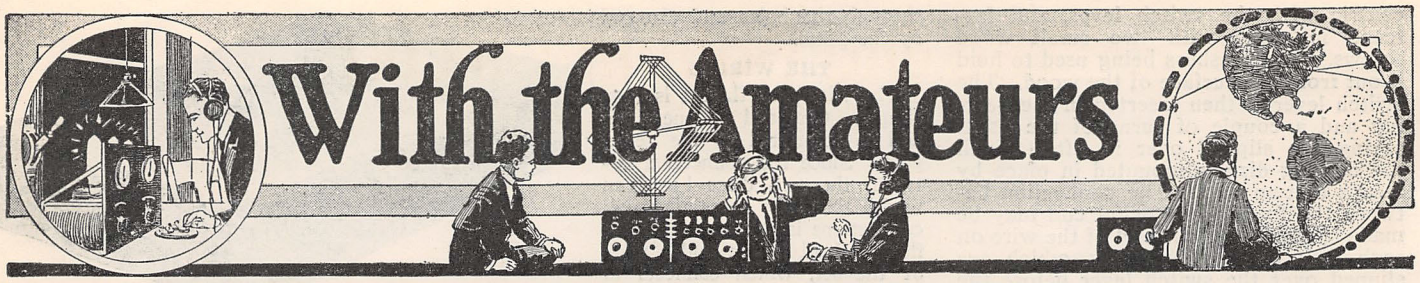
INTERFERENCE

"Concerning interference from existing stations with broadcast work, particularly Navy stations which I am more familiar with, I would like to point out that the Navy

(*Continued on page* 1756)

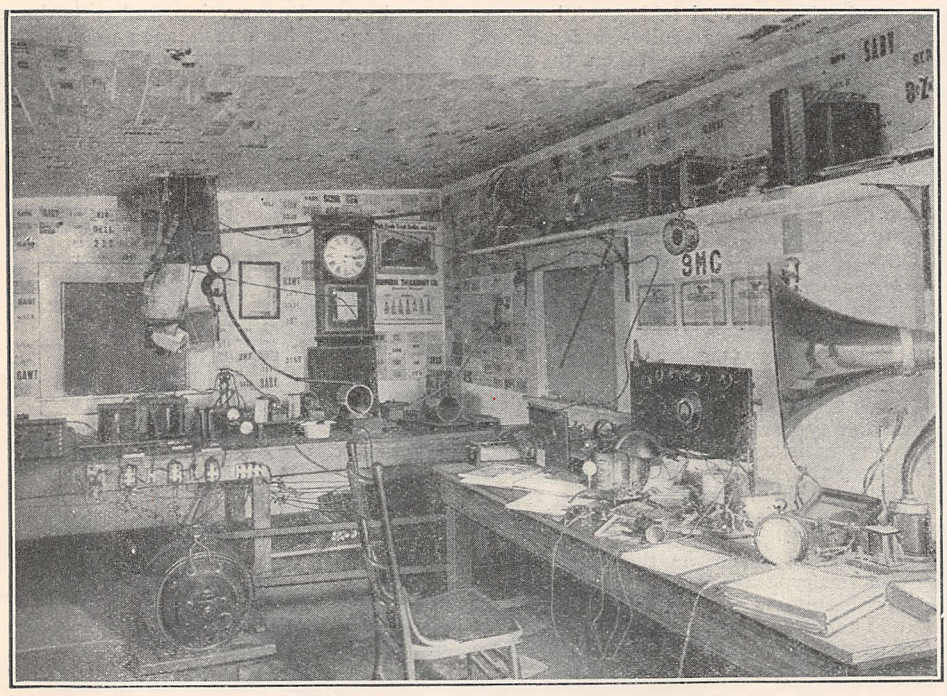
RESULTS OF THE SUPER-POWER BROADCASTING VOTE

FROM every state in the Union and from several faraway islands, broadcast listeners have sent their opinions relating to the increase of power for broadcast stations. The tabulation shows that approximately 80 per cent. of the fans favor the proposed increase of power. However, it must be said that the ones in favor of the change live in small towns or at great distances from large stations, and that those who live in cities where there are large broadcast stations are against the increase of power. The full results will be published in our next issue.



Hamitorial

"It's Time To Talk of Many Things—"



Station 9MC owned and operated by A. H. Cain and son, of Roadhouse, Ill. 9MC is one of the foremost stations of the A.R.R.L. and has an envious record, as may be judged from the cards pasted on the walls and ceiling. © Foto Topics, Inc.

THIS is by way of getting a lot of pet peeves and enthusiasms off my chest. —And there are many of the gang who suffer the same things, if my private spies are not deceiving me, who do it silently. Not having been raised in the great open spaces where a half kilowatt with an open gap coupled straight causes no swearing, I am not a silent man. Therefore, the wail.

First, I was out of the game for several years, until about six months ago. And when I returned, the most surprising thing of my re-entry was the continued existence hound. He is like charity, and worse; he is not only always with us, but he makes himself obvious on every occasion. And he seems never to have heard of the routine of calling, which demands that after punching several amps. into the antenna for as many minutes the operator at the key is supposed to sit and listen for at least 10 seconds. It is the only way—on my outfit at least—in which an answer can be heard. Of course, they may be so far advanced that they have some break-in system allowing them to hear while the key is not actually closing the transmitter circuit. And they may have two operators and a duplex station. If so, they're good guys and I'll swaller me words. If they are not, I hope—and I think the gang's with me—their tubes have measles of the plate and their filaments galloping consumption.

There was a time—and it wasn't so many years ago—when we didn't have the chance to get far from the maddening throng on the short waves. What a blessing. Let the brethren sit in solemn contemplation of those days when it was considered the efficient thing to get as high as possible. And let them join in fasting and prayer by way of thanksgiving for the new era. And then let them go up to the set and bring down the radiated to some of the newer bands which are not yet crowded. The efficiency is there, a fact which has been proven so often that it needs no further boosting.

It's entirely possible to clear the traffic hook on 40 or 80 meters—and nine-tenths of the time a much quicker process, if your fist is respectable—as it is on the regulation lengths. If the other fellow cannot get down to you on the receiver, the chances are that he will be rather slow on the brass or will be just a bit behind the times on the abbreviations. Get down to 40 or 80.

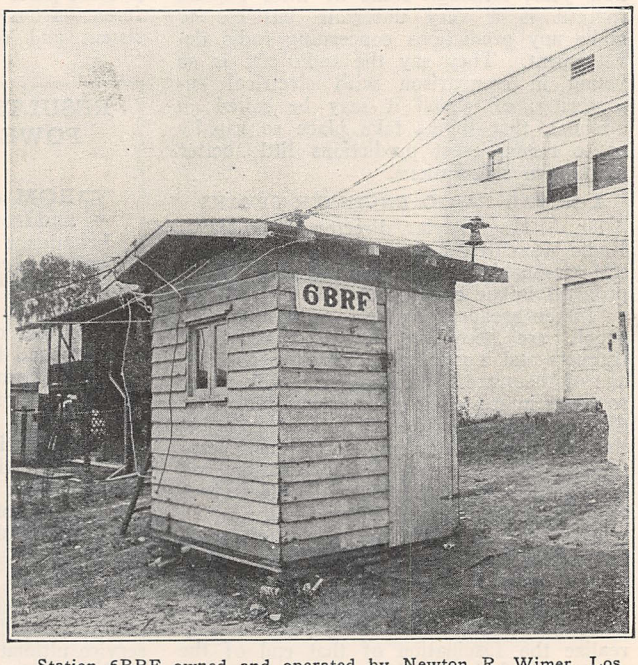
Then there is the gent who thinks that he is in the automatic transmitter class. The only explanation I can offer for this particular dolphin is that he makes a habit of trying to decipher and read the stuff that RCA sends out from Tuckerton and Rocky Point. That is the only psychological excuse which can possibly be mustered for the twisted neurones which result in a particular brand of fist which is heard as regularly as fish on Friday.

The other night I sat listening to a test being carried on by a 2 and a 5. From 11 o'clock until well after 12 they chewed the fat back and forth in an attempt to get together and do a bit of work. They didn't, and all because the 2 had an idea that his arm worked like a Western Union tape transmitter.

Then there is the guy who cannot keep his speed constant. Too much jazz is evidently his trouble. The nights he does not work he goes to jazz concerts and comes home with the idea that in speed there is beauty. Well, it may be beauty, but tastes differ. If the other fellow can't read you he's not going to be impressed with your speed because he does not know even who you are.

And here is another point. The other evening—this was a different one from that mentioned above—I sat holding seance with the cans for well over an hour trying to figure out who one chap was. He called very deliberately, no trouble at all to read the station he was trying to raise—and did raise—but when confronted with the question of the caller—ah; now that was a horse

(*Continued on page* 1769)



Station 6BRF owned and operated by Newton R. Wimer, Los Angeles, Calif. The whole shooting match is in the little shack shown. Note the counterpoise stretching out from roof. © Pacific and Atlantic.

The Old Dobbin Circuit

By JOSEPH RILEY

The description of an excellent two tube reflex receiver of new design wherein all the advantages of the crystal detector as a rectifier are had, without an accruent diminishing in sensitivity, as is usually the case.

THERE are dynes, flexes and supers just as there are Morovitches, Mano-Wars and Zevs. Then there are plain detectors, amplifiers and plain regenerators. The first named circuits are like the first named race horses. With the proper treatment and stable care they will do fine work. The latter receivers are like old Dobbin, always ready to work; not particularly fast, but able always to give good work and withstand a lot of rough treatment. The circuit described here is called the "Old Dobbin" because it is stable, requires little care for the proper functioning and is extremely easy to adjust and will always bring a station in at the same place on the dial.

NEW ARRANGEMENT

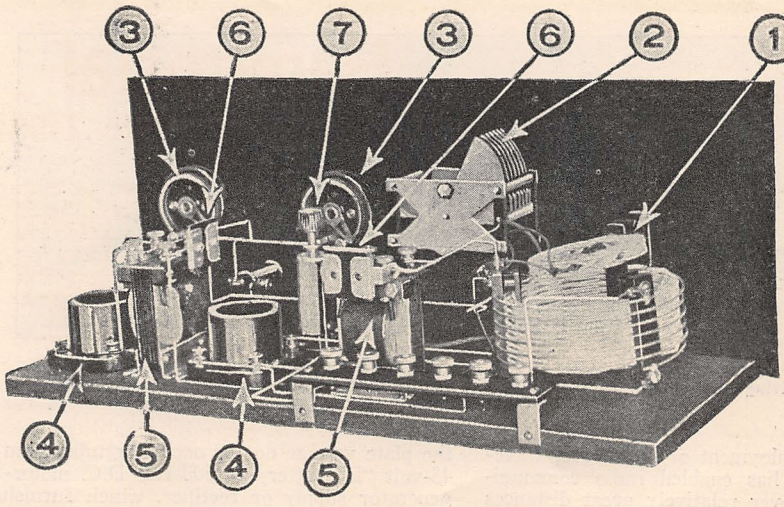
The fact that the reflex principle is employed does not necessarily imply that the statements above are paradoxical. An examination of the hook-up will show that the system is not the regular one, but is an entirely new adaptation. This plan gives all the advantages of the crystal rectifier, its clarity, faithfulness of reproduction, freedom from distortion, but the inclusion of the first tube in the same circuit with the crystal gives an added sensitivity which at once removes the crystal's greatest defect, *i. e.*, its inability to bring in the DX.

This last point is the location of the trick, simple in the last analysis, but very effective. The plate output of the first tube is passed to a tickler which couples with the secondary of the tuner; regeneration pure and simple, but worked from a new angle. Since the crystal lead is taken from a point in the center of the secondary winding, some of the radio frequency current of the signal reaches the grid of the first tube. This is slightly amplified and passed back through the tickler which in turn affects the secondary and also the crystal, giving the added sensitiveness of the tube with the advantages of the crystal.

Of course, both tubes in the set work at audio frequency also, giving two full stages of audio frequency amplification. On Manhattan Island the local stations were all received on a loud speaker using an indoor antenna. The DX reports were almost as good as those obtained from the regular regenerator with two stages.

Another point in favor of the set is the fact that the selectivity may be controlled at will. This is accomplished through the expedient of selecting the point at which the crystal output is taken from the secondary winding. If it is made from the top of the coupler, that is, at the same point from which the grid lead is taken, signals will be very loud, and the tuning of the set will be broad. By moving the point of connection down the winding, the selectivity is constantly heightened and, with it comes a slight decrease in signal strength. The builder must try several locations in order to find the one suiting his demands. Usually the center tap gives the best results.

If the set is to operate in an open district (as far as radio is concerned) the crystal, of course, may be operated from the grid lead. On the other hand, if it is to be installed in the heart of a large city where a number of broadcast stations are constantly putting their programs on the air, a lower point should be used.



A rear view of the completed set. The principal parts are: 1, low-loss variocoupler; 2, variable condenser (.0005 mfd.); 3, rheostats; 4, vacuum tube sockets; 5, audio frequency transformers; 6, fixed condensers (.002 mfd.), and 7, crystal detector.

PARTS NECESSARY FOR THE CONSTRUCTION OF THE SET

- 1 Low loss variocoupler.
- 1 Low loss variable condenser, capacity .0005 mfd.
- 1 Adjustable crystal detector.
- 2 Low ratio audio frequency amplifying transformers.
- 1 Double circuit jack.
- 1 Single circuit jack.
- 2 .002 mfd. fixed condensers.
- 2 30 ohm rheostats.
- 2 Standard vacuum tube sockets.
- 2 Vacuum tubes, 201A Type.
- 1 Panel 7 by 18 inches.
- 1 Baseboard, same dimensions.
- 6 Binding posts.
- 1 Binding post strip with supports.

Six feet of bus bar wire to make connections and screws, binding posts, etc.

REQUIRES NO BALANCING

This is a distinct advantage.

The second tube is the standard audio frequency stage. Both of the transformers used may be of the five to one ratio type though a lower ratio will give slightly better quality. The circuit is not at all difficult to hook up and requires no balancing as in the ordinary reflex. In fact, no trouble will be experienced in making it work after the parts have been assembled.

A 7 x 18-inch panel is used as the support. A smaller size may be used, but useless crowding of the components will result, so it is advisable to use the size indicated. The tuner is of the three-circuit untuned primary type, a commercial instrument of the low loss construction, that is, including the smallest possible amount of dielectric in the electrostatic field of the coils. Of late, the question of losses in tuners has made itself important. And since the necessities for low losses are known, it is easy enough to follow them in building a set. The secondary of the tuner is stagger wound and supported on three thin strips of bakelite. One of the strips is drilled to support the tickler. The constructor may support it by placing a bushing in the panel and passing the rod supporting the tickler coil through it. The tickler coil is of the spider-web type and may be wound on a form purchasable in any radio store.

The condenser is also of the low-loss type. Having the frame grounded separately, it is perfectly free from body capacity and also having the straight line wave-length

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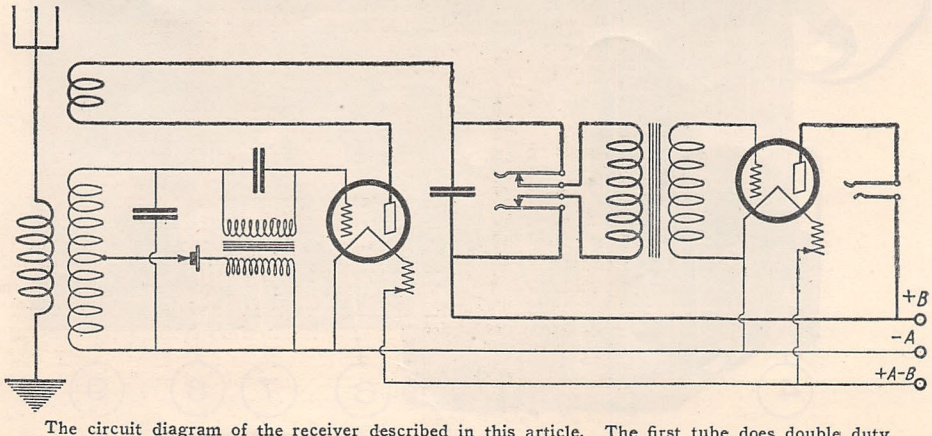
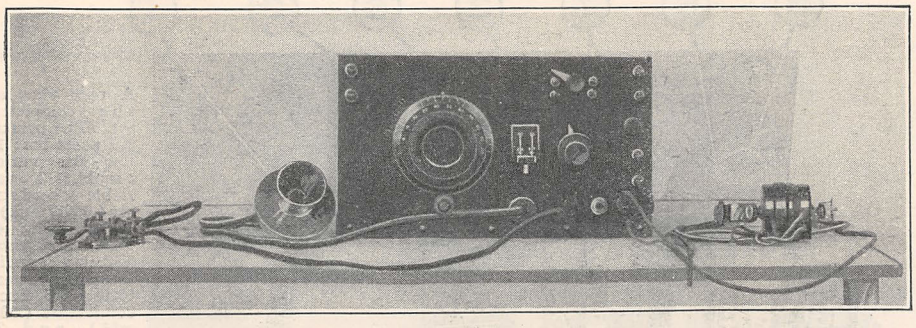


The circuit diagram of the receiver described in this article. The first tube does double duty, acting as both a radio and an audio frequency amplifier. Note the position of the crystal detector in the circuit. The condenser shown connected across the secondary of the coupler is a variable one of .0005 mfd. maximum capacity.

The Radio "Uni-Set"

By H. M. TOWNE, (1ADG)

The description of an excellent combination transmitter and receiver, simple of construction and highly efficient. As a transmitter, it can be employed for either C.W. or phone. Mr. Towne has given full constructional details.



A front view of Mr. Towne's "Uni-Set." The two switches employed for shifting from transmitting to receiving can be seen on the panel, one in the center and the other above the potentiometer knob.

THE employment of the shorter wavelengths has enabled radio communication over relatively great distances with surprisingly small amounts of transmitted energy. With the amateur wave bands of 75 to 80 meters and 150 to 200 meters, trans-continental communication has been repeatedly carried on during favorable night hours with transmitters of 5 watt rating, while the reliable daylight range of numerous amateur 5 and 10 watt transmitters is several hundred miles. Mindful of these performance records and the advantages of the small power outfits in the way of cost and simplicity, the writer desires to point out a still further utility in the combination of a short wave small power transmitter and receiving set into one unit which I have called the "Uni-Set."

In the design of any radio transmitter or receiver, there is essentially the same fundamental circuit. There is the coil system or tuning inductances together with capacitances either variable or fixed which, when combined with a vacuum tube, form an oscillating circuit with some measure of control of the energy feed-back from plate to grid circuit. In both the transmitter and receiver, the antenna is coupled either conductively or inductively to the tuning system. There is practically no transmitting circuit which cannot be used for reception of continuous wave telegraphy, and by providing control of the feed-back, voice reception becomes possible. Likewise, the majority of receivers used today are capable of transmitting, which fact is fairly well substantiated by the squeals and howls heard on broadcast reception in communities where the density of broadcast listeners is great. (The meaning of the word density is left optional with the reader.) The three-coil Meisner transmitting circuit bears a rather close resemblance to the ordinary two-circuit receiving tuner, and was chosen for the fundamental circuit in the "Uni-Set." This allows inductive coupling of antenna circuit, which is essential to the 75 to 80 meter transmission.

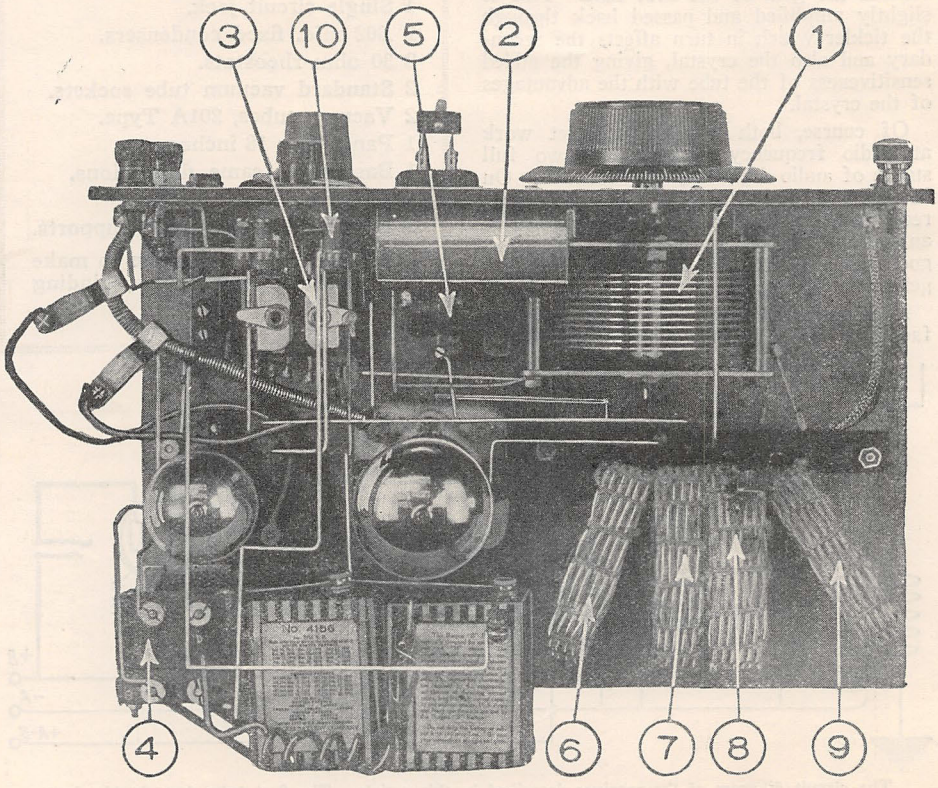
SWITCHING ARRANGEMENT

The diagram of connections of the "Uni-Set" is shown in Fig. 1. There is one tuning control, which is the variable condenser VC, which controls the adjustment of wave-length for both transmitting and receiving. There is one other control which is used for receiving only and that is the potentiometer, which provides for the adjustment of regeneration. It will be seen that the double pole double throw switch S_1 provides for changing the plate voltage on the oscillator tube from 45-volt "B" battery to 500-volt D.C. motor-generator supply or rectifier, which furnish the plate potentials for receiving and transmitting, respectively. In addition to throwing this switch S_1, it is necessary to close the double pole single throw switch S_2 when changing from receiving to transmitting. This inserts a .002 mfd. grid condenser with 10,000 ohm grid leak in series with the grid of the oscillator tube. When the switch S_2 is open for the receiving position, the grid condenser is .00025 mfd. with a 7 megohm grid leak. The closing of the switch simply puts a larger capacitance grid condenser and lower resistance grid leak in multiple with the receiving grid condenser and leak.

THE TUBES

In order that there be no unnecessary sacrifice in reception, one stage of audio frequency amplification is provided, using a standard audio transformer with UV-201A with 45 volts plate potential. As to the oscillator tube, I started out with a 201A, which was later replaced with a UV-202, a 5-watt tube. The latter tube required the addition of one 2-volt cell to my 6-volt storage battery, thus giving 8 volts for filament supply. The rated filament voltage being 7½ volts, it was necessary to insert a small series resistance between the "A" battery terminals on the "Uni-Set" and the filament, the resistance value being .22 ohm and of sufficient current rating for the 2.35 amps. filament current. Since the filament of the UV-201A amplifier tube must be supplied from the same "A" battery, a fixed resistance of 12 ohms must be inserted between the "A" battery terminals and the filament of the amplifier tube. This resistance with a filament current of ¼ ampere through it results in a 3-volt drop and thus gives the correct value of 5 volts on the amplifier filament terminals. Of course, filament rheostats might be used, but they represent unnecessary controls and require much greater space than the simple fixed resistance of correct value. A battery switch is inserted between the "A" battery binding posts and the filament circuits which provides for "on" and "off" control.

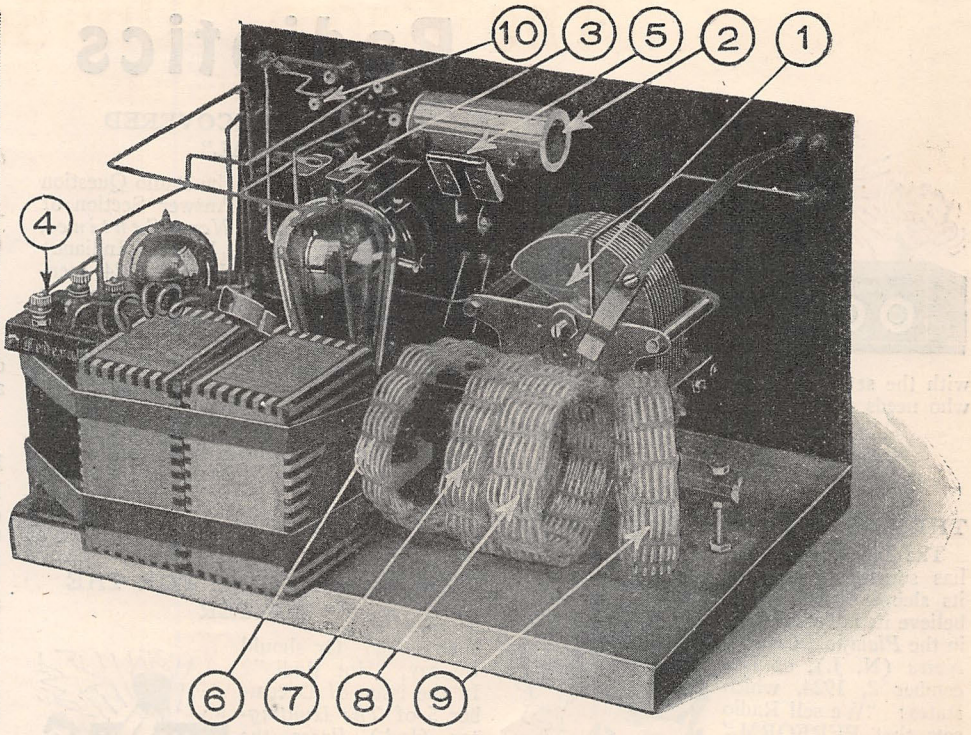
It should be noted from the diagram that the "B" battery voltage and plate circuit inductance are adjustable on the oscillator tube for the receiving position of the switch S_1. These adjustments provide an initial regulation of the feed-back or regeneration so that the final control is accurately accomplished



An interior view of the Uni-Set showing the position of the apparatus. Note the manner in which the coils are mounted. The parts in this photo are numbered the same as in the photo on the next page and are designated in that caption.

LIST OF MATERIAL REQUIRED TO CONSTRUCT THE "UNI-SET"

1 Low loss variable condenser .0005 mfd. capacity with direct and vernier controls and dial.
1 5-Watt radiotron UV-202.
1 UV-202A amplifier radiotron.
1 Pyrex low loss tube socket for oscillator tube.
1 Ordinary socket for amplifier tube.
1 200-Ohm potentiometer.
1 Audio frequency transformer.
2 Single circuit phone jacks.
2 Double circuit phone jacks.
1 .00025 mfd. grid condenser for receiving.
1 .002 mfd. grid condenser for transmitting.
1 .005 mfd. condenser for potentiometer by-pass.
1 .005 mfd. condenser for by-pass on switch S_1.
1 Rotary type double pole double throw switch S_1.
1 "Baby" double pole single throw knife switch S_2.
2 22½-volt "B" batteries with taps.
1 Receiving grid leak resistance 7 megohms.
1 Transmitting grid leak resistance 10,000 ohms.
3 Phone plugs for use with key, microphone and receivers.
1 Fixed filament resistance .22 ohm for 2.35 amperes.
1 Fixed filament resistance 12 ohms for .25 amperes.
1 Battery switch for "A" battery.
6 Binding posts.
1 Panel 7 x 12 x ¼ inches.
1 Baseboard 7 x 12 x ⅞ inches.
Coil systems as described.
1 Microphone transmitter.
1 Telegraph key.
1 Set telephone receivers.
1 Low loss variable condenser .00025 mfd. for inserting in series with antenna for short wave work.
Miscellaneous screws, nuts, bus wire.



A rear view of the Uni-Set. The parts are: 1—variable condenser; 2—transmitting grid leak; 3—receiving grid condenser; 4—A.F. transformer; 5—transmitting grid condenser; 6—grid coil; 7—antenna coil; 8—plate coil; 9—microphone coil; 10—double pole, double throw change over switch.

with the potentiometer. I have found that adjustment of "B" battery voltage alone (about 10½ v.) will give about the proper regulation so that perfect control of regeneration is had with the potentiometer. It should be noted that the adjustment of the potentiometer has no effect whatever on the oscillator when the switch S_1 is in the transmitting position. A .005 mfd. by-pass condenser shunts the radio frequency out of the potentiometer.

Separate jacks are provided for the telephone receivers, telegraph key, plate milliammeter and microphone, the latter being used with the loop absorption method of modulation for voice transmission. For C.W. telegraphy, the key may be plugged in the plate circuit jack using an external series reactor and shunt condenser to minimize key clicks, or, the keying can be done in the grid and plate returns to the filament. I have been using the latter method, which in the set described has the slight disadvantage of requiring the extra operation of pulling out the key plug when changing from transmitting to receiving. It is desirable to remove the microphone plug from its jack when using C.W. telegraphy to avoid any absorption of energy in the modulating loop.

THE COILS

As will be seen from the photographs, the coil system employs low loss basket wound coils. These are three inches in diameter and consist of 16 turns of 16 D.C.C. wire, with

(*Continued on page* 1758)

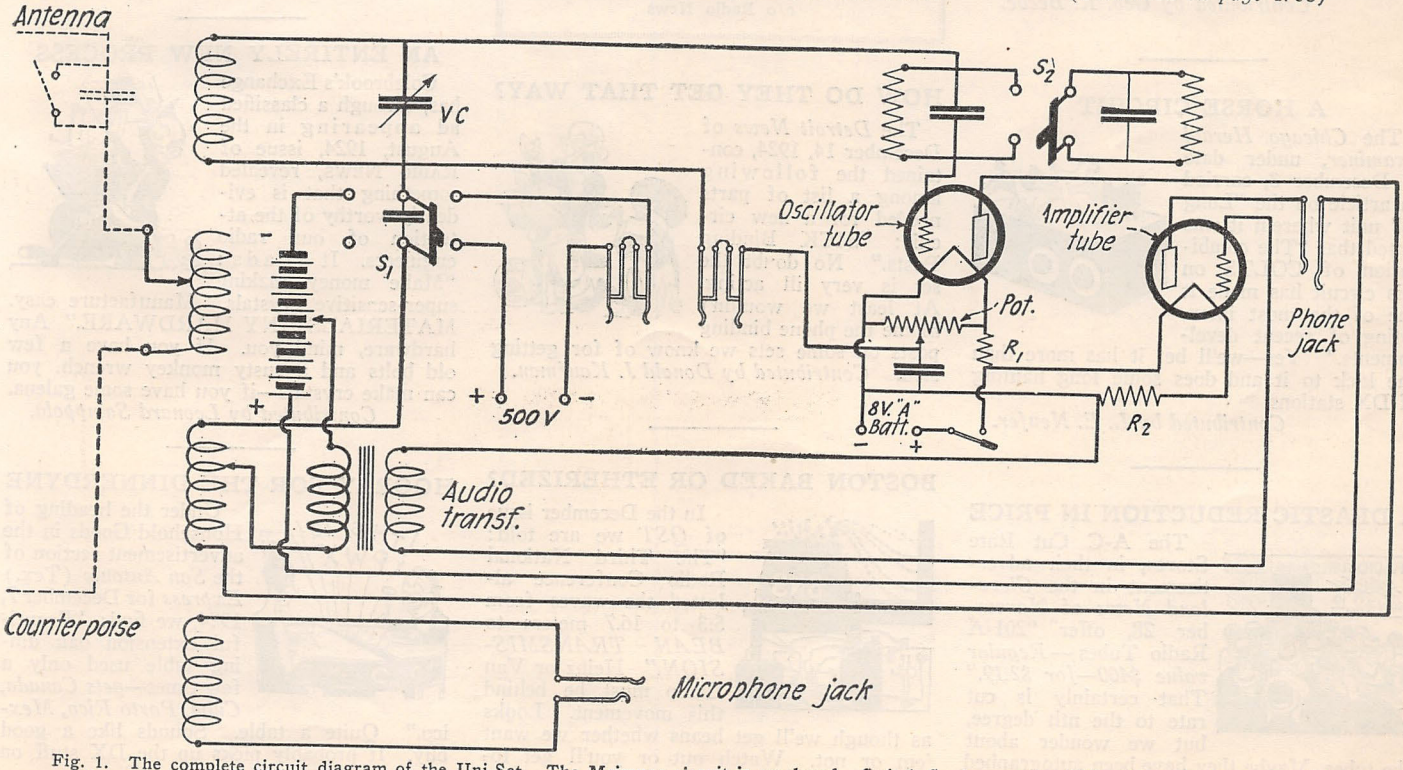
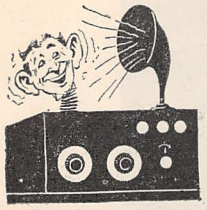


Fig. 1. The complete circuit diagram of the Uni-Set. The Meissner circuit is employed. Switch S, changes the "B" voltage on the plate of the oscillator tube, for transmitting or receiving and the potentiometer controls regeneration or oscillation when receiving. Switch S2 throws the transmitting grid leak and condenser into circuit.

Radiotics

EARS FOR SALE



The *Montreal Daily Star,* of November 12, carried the following unique classified advertisement for the sale of a radio set: "Radio, three lamps with LISTENER."

Zounds—does the man wish to sell himself with the set, as a listener, or is it his wife who needs to practice silence?

Contributed by C. Vosberg.

THEY DO EVERYTHING BUT SING

The Ideal Music Co. has something new up its sleeve, if we are to believe its advertisement in the *Plainfield Courier News* (N. J.), of December 2, 1924, which states: "We sell Radio sets that PERFORM." They probably carry all types from blackface comedy act Neutrodynes to single tube jazz opera Reinartz sets.

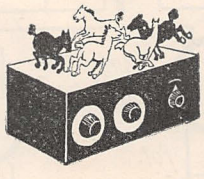
Contributed by Manuel Smith.

A NEW RADIO FOOD

In the Saturday issue of the *Radio Sun & Globe* (N. Y.) the Larson Engraving Co. advertise: "Radio panels cut, GRILLED, engraved at the lowest prices." It would have better read—cut, grilled, in-gravy, but in any case—who wants to eat a radio panel—and otherwise why grill it.

Contributed by Geo. R. Beebe.

A HORSE CIRCUIT



The *Chicago Herald Examiner,* under date of December 3, carried an article on the "Long 45" unit wherein it was stated that "The combination of COLTS on this circuit has made it one of the most interesting of recent developments." Yes—we'll bet it has more than one kick to it and does some long hauling of DX stations.

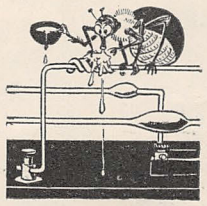
Contributed by L. E. Neufer.

A DRASTIC REDUCTION IN PRICE

The A-C Cut Rate Stores, in their advertisement in the *Cleveland News* of November 28, offer "201-A Radio Tubes—*Regular value $400—for $2.19.*" That certainly is cut rate to the nth degree, but we wonder about the tubes. Maybe they have been autographed by H. R. H. the Prince of Wales.

Contributed by K. L. Martin.

A NEWLY DISCOVERED "ANIMAL"



In the Radio Question and Answer Section of *The News Sentinel,* Fort Wayne, Indiana) for November 24, mention is made of the "use of SOLDERING BUGS in wiring a set——." We never heard of soldering bugs before, but there is a fortune awaiting the man who will raise them. There is a crying need for bugs that will do such work.

Contributed by L. B. Wilcox.

JUST THE THING FOR THE WINTER

Hot dog! Or should we say, "Hot Radio"? In the issue of December 5 of *The Huntington* (Ind.) *Press,* the Mitten Electric Shop advertises "Super-HEATERDYNE Sets." Come to think of it, there ought to be quite a bit of heat generated with six or eight tubes burning.

Contributed by W. A. Dill.

If you happen to see any humorous misprints in the press, we will be glad to have you clip them out and send to us. No RADIOTIC will be accepted unless the printed original giving the name of the newspaper or magazine is submitted. We will pay $2.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to

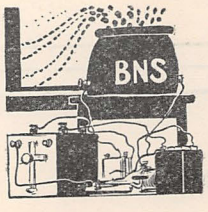
Editor RADIOTIC DEPARTMENT,
c/o Radio News

HOW DO THEY GET THAT WAY?

The *Detroit News* of December 14, 1924, contained the following among a list of parts needed for a new circuit: "SICK Binding Posts." No doubt the set is very ill acting. At least we wouldn't blame the phone binding posts on some sets we know of for getting sick.

Contributed by Donald J. Kaufman.

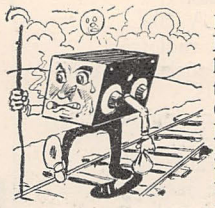
BOSTON BAKED OR ETHERIZED?



In the December issue of *QST* we are told: "The Third National Radio Conference allotted the waves from 5.3 to 16.7 meters to *BEAN TRANSMISSION.*" Heinz or Van Camp must be behind this movement. Looks as though we'll get beans whether we want 'em or not. Watch out or you'll get tomato sauce in your ears.

Contributed by D. Lloyd.

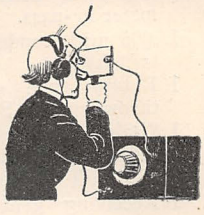
MARVELOUS!



In the November, 1924, issue of RADIO NEWS appears the following classified advertisement inserted by George D. Lynn: "A Radio Distributor—for a TRAVELING RADIO RECEIVER." Man—that radio set doesn't need a distributor—what it needs is a nurse.

Contributed by Hanky Kucera.

NEW ROLE FOR A CONDENSER



In the June 1, 1924, edition of the Kansas City *Journal-Post,* there is included in a list of parts for constructing a crystal set: "One fixed mica condenser of .001 MAGNIFYING capacity." The magnifying powers, no doubt, lie in the mica—but who wants a magnifying condenser—whatever that may be?

Contributed by W. R. Bennett.

THE BARK IS WORSE THAN THE BITE

The *Charleston* (W. Va.) *Gazette* of November 22, 1924, carried the following hot-dog ad: *"One Radio Hound—Owner can have same by calling——."*

After reading this I am of the opinion that it must be the same hound which was howling in my set a short while ago, and I would suggest that the owner be compelled to keep the brute in a shielded and grounded dog house.

Contributed by C. C. Heyder.

AN ENTIRELY NEW PROCESS

Colebrook's Exchange has, through a classified ad appearing in the August, 1924, issue of RADIO NEWS, revealed something that is evidently worthy of the attention of our radio engineers. It reads: "Make money making super-sensitive crystals. Manufacture easy. MATERIALS ANY HARDWARE." Any hardware, mind you. If you have a few old bolts and a rusty monkey wrench, you can make crystals—if you have some galena.

Contributed by Leonard Samppola.

HOORAY FOR THE DINNERDYNE

Under the heading of Household Goods in the advertisement section of the *San Antonio* (Tex.) *Express* for December 7, 1924, we find: "Beautiful extension oak dining table used only a few times—*gets Canada, Cuba, Porto Rico, Mexico.*" Quite a table. Sounds like a good buy. It probably picks up the DX stuff on the extension.

Contributed by A. J. James.

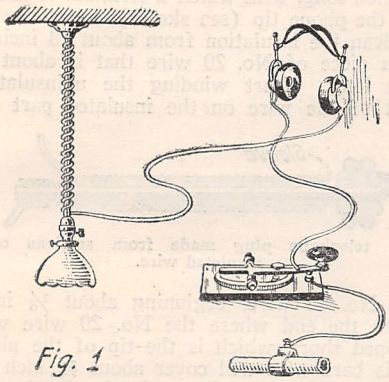
Awards of the $50 Radio Wrinkle Contest

First Prize

AN INTERESTING CODE PRACTICE METHOD

By L. W. HATRY

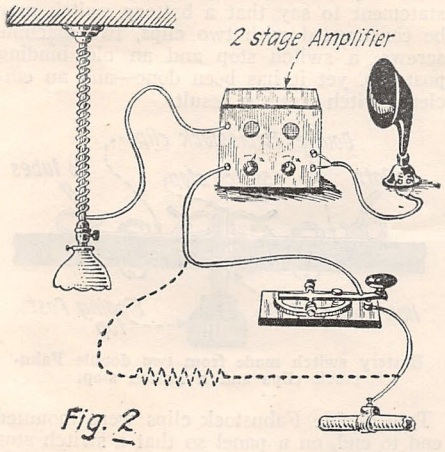
A coil of small wire is wound up the drop of an electric light to about 20 or 30 turns and a pair of phones and key are connected in series with it and the ground, as shown in Fig. 1. All then



Employing the A.C. hum of the lighting system for practicing the code.

that remains is to work the key to get a clear musical note very like some C.W. whistles. More than one pair of phones may be used, if desired.

For use at the radio club, a two-step amplifier with a loud speaker connected as in Fig. 2 will give sufficient volume to fill any room when the key is worked.



By inserting a two-stage A.F. amplifier and a loud speaker, sufficient volume is had for filling a room.

For a novelty practice method that gives an action almost exactly like the sound of an arc transmitter with its backwave, it is necessary to place a resistance as shown by the dotted lines in Fig. 2. The resistance R can sometimes be a pair of head-phones or two pairs in series, depending on the input impedance of your amplifier. Again R can be a ½ or ¼ megohm gridleak or a couple of either in parallel as is found necessary.

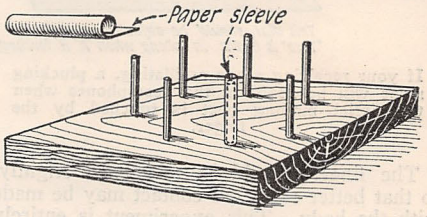
2nd Prize

PAPER SLEEVES FOR BASKETWEAVE COILS

By C. E. MULTOG

Doubtless many experimenters who roll their own basketweave coils have had the misfortune to scrape the insulation from the wire when removing the coil from the pegs, even though great care was exercised in the act.

This difficulty may be overcome by making paper sleeves to slip over the pegs. When the completed coil is removed from the pegs, the paper sleeves slip off, too. As



Paper sleeves slipped over the nails on a coil winding form make it easy to get the coil off when completed.

they are soft, they may be withdrawn from the coil easily, leaving the insulation intact.

The paper sleeves may be made of light wrapping paper about one inch wide and the same length as the peg. The paper is rolled smoothly around the peg and fastened along the edge with glue or shellac. The sleeves must slip off the pegs easily, so that when the coil is completed, there will be no tendency for the wire to bind on the pegs.

Prize Winners

First Prize $25
AN INTERESTING CODE PRACTICE METHOD
By L. W. HATRY,
Hartford, Conn.

Second Prize $15
PAPER SLEEVES FOR BASKETWEAVE COILS
By C. E. MULTOG
5934½ N. Paulina St.,
Chicago, Ill.

Third Prize $10
FASTENING THE PRIMARY OF HOME-MADE COILS
By JOSEPH C. COFFEE
c/o Wales Adding Machine Co.,
Kingston, Pa.

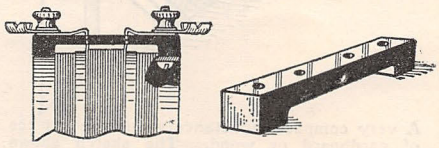
Note: The next list of prize winners will be published in the May issue.

3rd Prize

FASTENING THE PRIMARY OF HOME-MADE COILS

By JOSEPH C. COFFEE

In the construction of apparatus many little problems arise, the most frequent one being how the wire wound on a coil shall be fastened. It is a simple thing to fasten



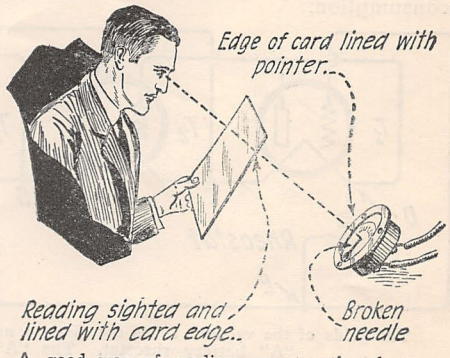
A good way to fasten the leads of the primary coil of an air core radio frequency transformer.

wire when it is wound flat on a tube, but when there is one winding placed over another, the constructor may resort to the method illustrated in the accompanying sketch.

A strip of bakelite or hard rubber ¼ x ¼ inch and as long as the tube is wide, is used. Two holes are drilled $\frac{3}{16}$ inch from each end large enough to take an 8/32 machine screw. This bakelite is filed out in order to clear the windings, as shown in the sketch. Two $\frac{1}{16}$-inch holes are drilled directly over the ends of the primary coil, the ends of which are drawn through these holes and fastened to the 8/32 machine screws, which clamp the bakelite to the tube. The knurled nuts from a discarded dry cell may be used to form binding posts.

READING A METER WITH A BROKEN NEEDLE

Many times the needle of a meter becomes broken, making it almost impossible to take accurate readings. The following method may prove of assistance; it may also find application in taking accurate readings where the dial of the meter is not equipped with a mirror. In the latter case, if precision is desired, the operator must be sure that he is looking at the needle vertically. The system here delineated assures this fact.



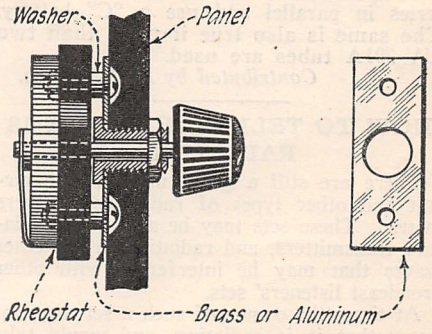
A good way of reading a meter that has a broken needle.

Most meters have enameled dials. For taking the accurate readings, hold a piece of cardboard or paper, with a true edge, between the eye and the meter, and sight from the edge of the card to the edge of its reflection in the dial. Line the two up with the needle and take the reading.

Contributed by Don M. Mumford.

ONE HOLE MOUNTING FOR RHEOSTATS

The majority of the rheostats are made today with two mounting screws, and in very few instances are these screw heads covered by a dial on the front of the panel.



A simple way of mounting a rheostat without having to drill holes in the panel for the screws.

The idea here presented is to eliminate these screw heads and so improve the appearance of the panel.

A piece of either a 3½-inch sheet brass or an aluminum plate from an old con-

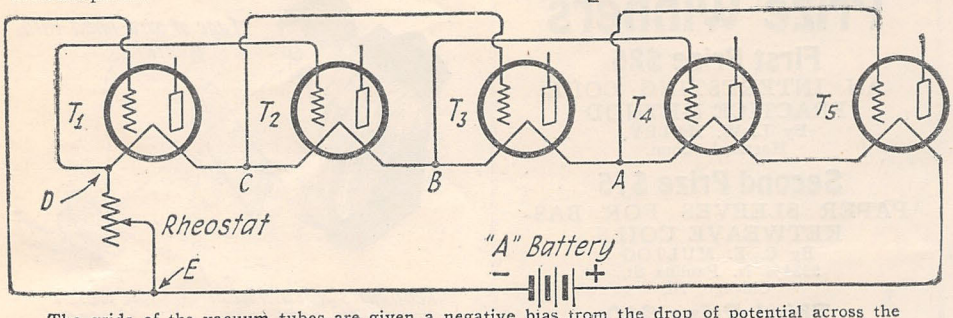
denser, about 2 x ½ inch is drilled as follows: A hole ⅜ inch in diameter in the middle and two holes large enough to take the screws provided for fastening the rheostat to the panel are drilled in their relative positions to the rheostat. Two 6/32 round head screws are used to fasten the rheostat to the strip. Countersink two holes in the panel to fit the screw heads so that the strip will lie flat on the panel.

A bushing is prepared to fasten this strip to the panel by drilling a piece of ⅜-inch brass rod, so that the shaft of the rheostat will turn easily in it. The outside of the bushing is threaded and a corresponding thread is cut in a hole in the panel. This bushing is placed through the panel and the strip with the screws in place fastened with a nut. The rheostat is then placed on the projecting screws and secured with nuts.

Contributed by W. B. Scofield, Jr.

GRID BIAS WITHOUT "C" BATTERY

The principle employed is the drop in voltage that occurs in a circuit in which there is a current flowing through resistance. In amplifying tubes, having the voltage of the grid negative with respect to the filament means greater efficiency in reception and a smaller "B" battery consumption.



The grids of the vacuum tubes are given a negative bias from the drop of potential across the "A" battery rheostat. The "A" battery supplies the "C" voltage.

In Fig. 1, with WD-12 tubes connected in series, the IR drop across the filament of each tube gives the necessary negative voltage value to the grid. If it is desired to have the grid of the last tube of greater negative value, connect the grid return of T-5 to the point B instead of A. The grid return of T-1 is placed at the point E and utilizes the resistance of the rheostat for the IR drop. The drop across the filament of a WD-12 is 1.1 volts, so that it may be easy to calculate what voltage there is on a tube by the position of the grid return lead.

In the case of UV-199 tubes being used, so many dry cells would be necessary if a series arrangement were employed, that it would be better to connect the "A" batteries in parallel and use a "C" battery. The same is also true if more than two UV-201A tubes are used.

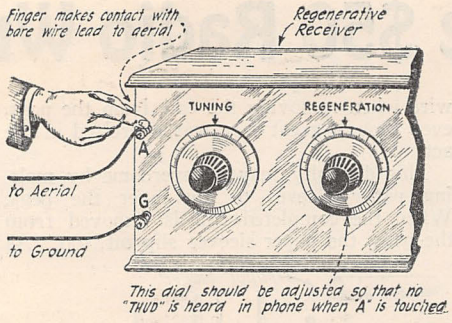
Contributed by H. D. Hatch.

HOW TO TELL WHEN A SET IS RADIATING

There are still a great many single circuit and other types of radiating receivers in use. These sets may be acting as miniature transmitters, and radiating in the ether waves that may be interfering with other broadcast listeners' sets.

At times the owner of such a set may not know that it is radiating, and would take steps to correct the trouble, if he knew.

One of the easiest methods to determine whether one's radio set is radiating into the ether is to simply touch the antenna binding post. A faint thud will be heard in the phones, even if the radiation is very small. The correction is simple: Merely adjust the tickler coil, or other regeneration control, until this sound is no longer heard.



If your receiving set is oscillating, a plucking noise will be heard in the head-phones when the aerial binding post is touched by the finger.

The finger should be moistened slightly, so that better electrical contact may be made with the body. This experiment is entirely free from bodily harm, and is a very interesting one.

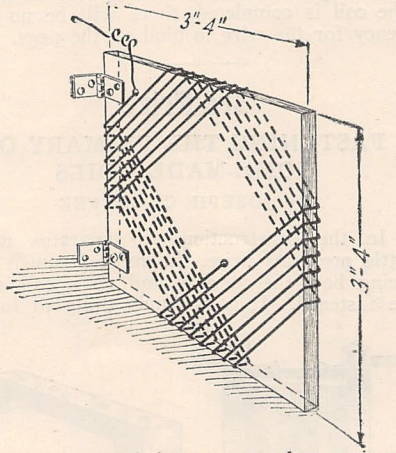
Contributed by Floyd French.

A NOVEL WINDING INDUCTANCE

A novel and handy method of winding inductances, so that they will not take up too much space, and yet be efficient, is illustrated herewith.

The frame consists of a piece of bakelite, hard rubber or other supporting insulating material, about 3 to 6 inches on the side, according to the size of the inductance unit desired.

A small hole is drilled for the beginning and end of the winding, which continues as shown in the drawing. No "dope" or varnish is necessary to hold the coils in shape, and if the job is well done a neat and very presentable unit is the result.



A very compact inductance wound on a piece of cardboard or wood. The sketch shows clearly how the wire is wound.

For tickler circuits and others requiring a means of coupling, the plate can be equipped with small brass hinges, as shown. The degree of coupling is controlled by the swing of such a coil. These coils can be used as any other types, in any kind of a circuit.

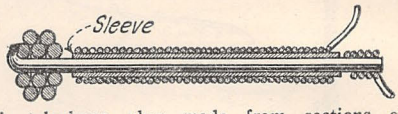
Contributed by Charlie Olson.

EMERGENCY PHONE PLUG

An easily constructed emergency phone plug that will fit the standard jack is shown in the accompanying sketch. The only materials needed are a short length of No. 18 B. & S. gauge D.C.C. solid copper wire and a few feet of No. 20 B. & S. gauge S.C.C. solid copper wire.

Remove about ¼ inch of the insulation from each end of a piece of the No. 18 wire, which should be about 1¾ inches long. Scrape enough of the No. 20 wire clean to wind two layers on each end of the No. 18 wire, clipping the winding at one end off short and allowing the other to remain about an inch long, with which a terminal is made for the phone tip (see sketch).

Clean the insulation from about 18 inches of a piece of No. 20 wire that is about 2 feet long. Start winding the uninsulated part of the wire on the insulated part of



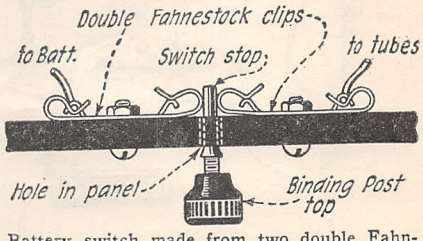
A telephone plug made from sections of insulated wire.

the No. 18 wire, beginning about ⅛ inch from the end where the No. 20 wire was clipped short, which is the tip of the plug. This bare wire will cover about ¾ inch of the No. 18 wire. Then the insulated part of the No. 20 wire is wound on nearly to the end of the insulated No. 18 wire, the insulation thus forming a place to hold the plug. The end of the No. 20 wire is formed into a terminal, as was done with the inside wire.

Contributed by E. C. Morrison.

HOME-MADE BATTERY SWITCH

It may seem at first rather a startling statement to say that a battery switch may be constructed with two clips, two machine screws, a switch stop and an old binding post top, yet it has been done—and an efficient switch was the result.



Battery switch made from two double Fahnstock clips and a switch stop.

Two double Fahnstock clips were mounted end to end, on a panel so that a switch stop would fit snugly between them, thus making a connection. A hole was drilled through the panel large enough to admit the switch stop, to which is fitted the rubber top of the binding post for a handle, as shown in the sketch. The outer ends of the clips are connected to the battery and filament terminals of the tubes.

Contributed by Harold Fraulob.

SHOULD GROUND HOUSE LIGHTING CIRCUITS

"Transformer secondaries should always be grounded when carrying less than 150 volts; grounding recommended up to 440 volts."

The grounding of electrical circuits supplied from the low voltage side of transform is recommended as a safety precaution by Dr. M. G. Lloyd, Chief of the Safety Section of the Bureau of Standards, Department of Commerce. In a paper presented at the meeting of the International Association of Municipal Electricians, Dr. Lloyd pointed

.. (*Continued on page* 1799)

STANDARD HOOK-UPS

EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

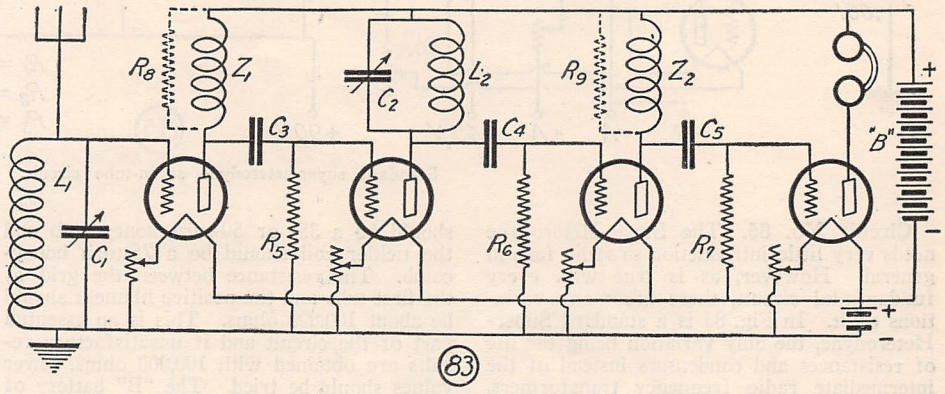
Handy Reference Data for the Experimenter

Circuit No. 83. In Fig. 83 is shown an English circuit comprising three stages of radio frequency amplification and a detector. Z1 and Z2 are choke coils and are wound on a tube 2 inches in diameter, using 350 turns of No. 30 B. & S. gauge D.C.C. wire. L1 and L2 are made of 54 turns of No. 20 B. & S. gauge D.C.C. wire wound on a 3-inch tube. The variable condensers, C1 and C2, have a capacity of .0005 mfd. The three condensers in the plate circuits of the tubes, C3 and C4, have a capacity of .0005 mfd. and C5, a capacity of .00025 mfd. The resistances, R5, R6 and R7, have a value of 70,000 ohms. There are shown two resistances, R8 and R9, of a resistance between 50,000 and 100,000 ohms, that may be used instead of the choke coils. UV-199 tubes may be used in this set, but UV-201A tubes will give better volume. In this circuit, although three stages of radio frequency amplification are used, there is but one condenser to tune, controlling these three stages. With the other condenser in the grid circuit of the first tube, this makes the set as easy to tune as one with but one stage of radio frequency amplification and detector.

It may be seen that the different circuits in the radio frequency amplifier are alternately tuned and aperiodic. If, for example, the first grid circuit is tuned, the plate circuit of that tube will be aperiodic. The next plate circuit will be tuned and the next one aperiodic. If the experimenter so desires he can use a considerable number of stages of radio frequency amplification without it ever happening that both the grid and plate circuits of the same tube being tuned.

Although the aperiodic coupling does not give as great an amplification as the tuned plate coupling, it serves as an excellent means of separating two circuits which, if placed together in the same tube, would cause oscillation. Not only does the aperiodic circuit perform these functions, but it also helps by giving a material degree of radio frequency amplification.

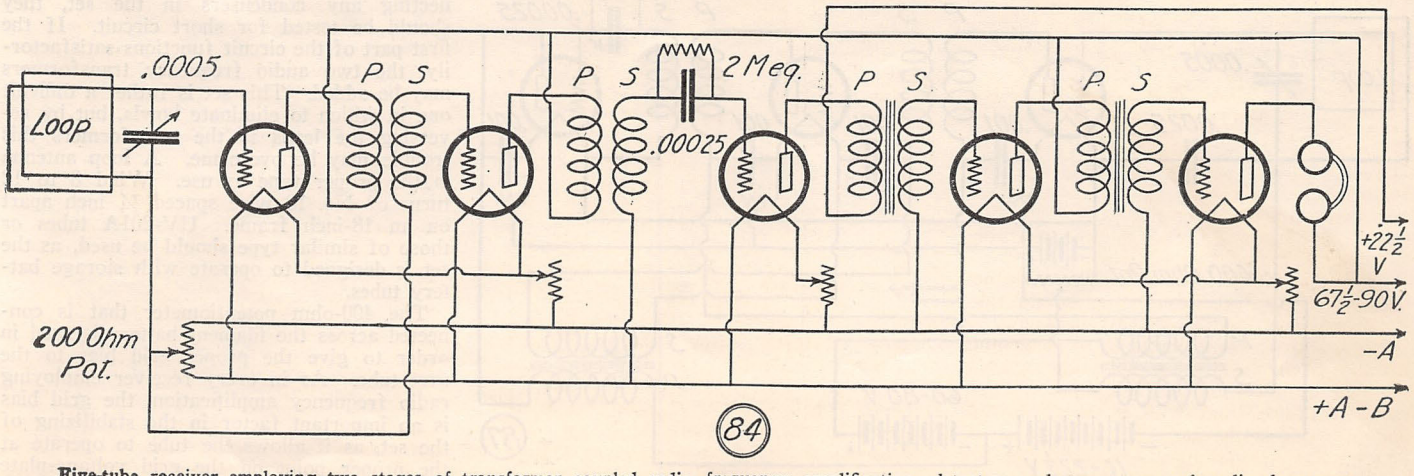
Naturally the use of these circuits halves the number of circuits to tune and also reduces the number of controls to half those that would be necessary if each circuit was tuned. This alone should prove to be a great advantage to anyone having experienced the tuning of a multi-tube radio frequency amplifier. This fact, combined with extraordinary stability, should recommend the circuit to the experimenter.



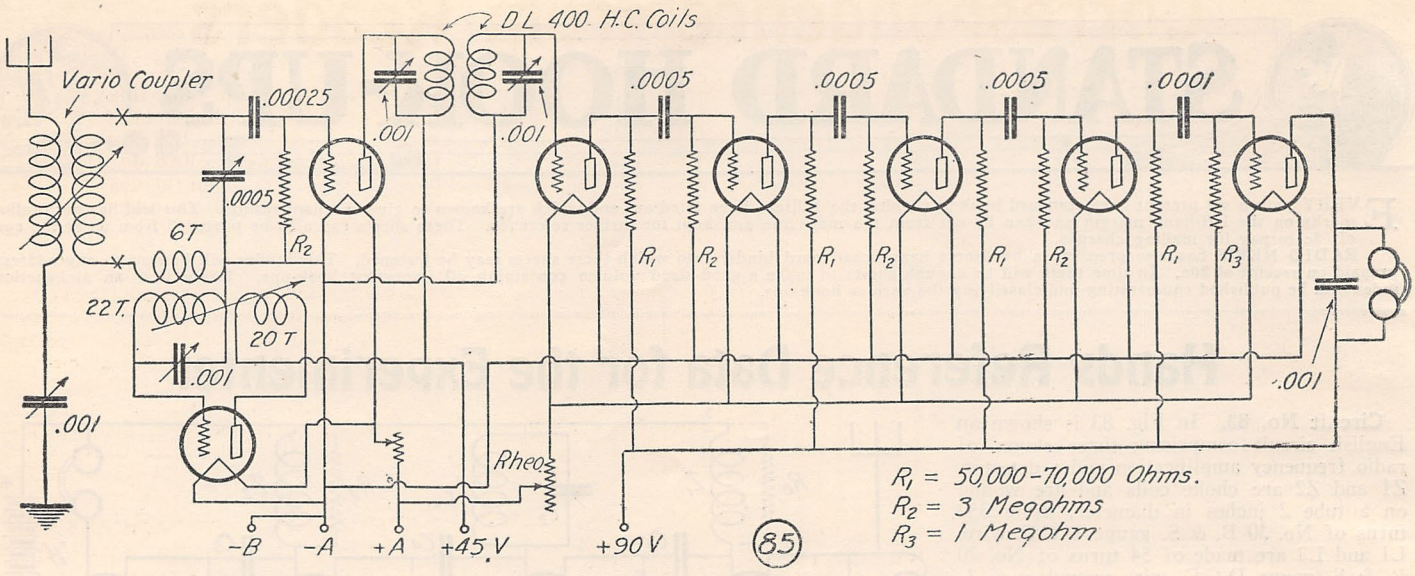
Three stages of radio frequency amplification and detector employing the T.A.T. system.

Circuit No. 84. For the fan who is looking for a set that brings in the stations consistently we can recommend the circuit shown in Fig. 84. It has two stages of transformer coupled radio frequency amplification, detector, and two stages of audio frequency amplification. One of the greatest advantages of the set is that there are but two controls—the .0005 mfd. condenser shunted across the loop antenna and the potentiometer that adjusts the grid bias on the first two tubes. Any good make of radio frequency transformer may be used. However, proper precautions should be taken to prevent any inductive coupling between them. The condenser should be of the low-loss type and a vernier adjustment is essential. UV-201A tubes are recommended for use in this circuit, as the volume will be greater with these tubes than with the smaller types. Both tubes in the amplifying stages are shown controlled by one rheostat, as these filament voltages are not critical. A loop antenna may be used with good results, but if an outside antenna is used then a variocoupler will have to be connected in place of the loop. The variable condenser will be shunted across the secondary of the coupler, the primary forming an aperiodic antenna circuit.

Above it was mentioned that any good make of radio frequency transformer would suffice in the plate circuits of the first two tubes; it should also be stated that the transformers should be built around laminated iron cores. When purchasing radio frequency transformers, the buyer should ascertain the wave-length band that the transformer is designed to cover. If the receiver is designed for broadcast reception, the transformers should be designed to cover a wave-length band from 200 to 600 meters. The selection of the radio frequency transformers should be carefully made, as the receiver will not function at maximum efficiency unless there are excellent transformers in the circuit.



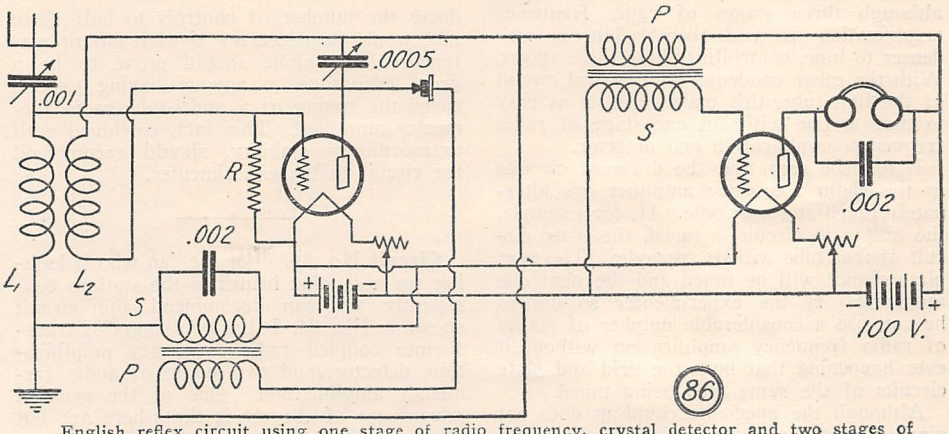
Five-tube receiver employing two stages of transformer coupled radio frequency amplification, detector, and two stages of audio frequency amplification.



Standard super-heterodyne seven-tube circuit.

Circuit No. 85. The Super-Heterodyne needs very little introduction to radio fans in general. However, as is true with every fundamental circuit, there are many variations of it. In Fig. 85 is a standard Super-Heterodyne, the only variation being the use of resistances and condensers instead of the intermediate radio frequency transformers. Almost all the values of the apparatus are shown in the diagram. At the points marked X in the connections from the secondary of the variocoupler, a loop antenna may be substituted for a coupler. The two .001 mfd. variable condensers shunted across the honeycomb coils, after once being set, need very little adjusting, the set being tuned with the three other variable condensers. However, if a loop antenna is used instead of the variocoupler, this will reduce the tuning controls to two. The leads from the resistances and condensers should be kept as short as possible. The 6- and 22-turn coils may be wound on the same 3-inch tube, the 20-turn coil being wound on a tube that will rotate freely inside the 3-inch tube. The use of UV-201A tubes is recommended for this circuit.

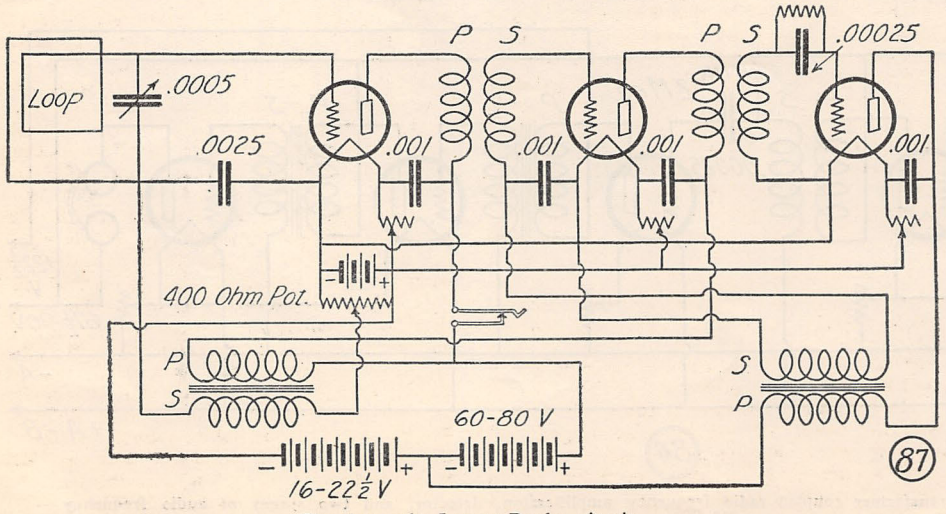
Circuit No. 86. The S.T.-100 circuit is a stage of radio frequency amplification, crystal detector, and two stages of audio frequency amplification. The S.T.-100 is one of the easiest reflex circuits to build, there being nothing tricky about it. The usual precautions in wiring a set should be observed, as short leads from and to transformers, etc. The antenna inductance L1 should be a 35- or 50-turn honeycomb and the tickler coil should be a 75-turn honeycomb. The resistance between the grid of the first tube and the positive filament should be about 100,000 ohms. This is an essential part of the circuit and if unsatisfactory results are obtained with 100,000 ohms, lower values should be tried. The "B" battery of 100 volts may be shunted by a 1 mfd. condenser. Because there is but one stage of radio frequency amplification, the S.T.-100 is not very effective on long distance signals. Its chief use seems to be in obtaining very loud signals within a 50-mile range. Also the reception on a loud speaker is much better than when phones are used. By applying 4.5 to 9 volts on the grids of both tubes, the quality of speech and amplification is materially improved.



English reflex circuit using one stage of radio frequency, crystal detector and two stages of audio frequency amplification.

Circuit No. 87. The Inverse-Duplex circuit shown in Fig. 87 is so arranged that each tube does the work of two. In many reflex circuits some tubes do more work than others and an unbalanced circuit results with correspondingly poor reception. The Inverse-Duplex is so designed that all parts of the circuit are balanced. Before the audio frequency stages of amplification are added, the radio frequency stages and detector should be tested. Also before connecting any condensers in the set, they should be tested for short circuit. If the first part of the circuit functions satisfactorily, the two audio frequency transformers may be added. This set is rather a difficult one in which to eliminate howls, but by reversing the leads to the transformers this trouble may be overcome. A loop antenna is the proper type to use. Wind 8 to 12 turns of No. 18 wire spaced ¼ inch apart on an 18-inch frame. UV-201A tubes or those of similar type should be used, as the set is designed to operate with storage battery tubes.

The 400-ohm potentiometer that is connected across the filament battery is used in order to give the proper grid bias to the first tube. As in every receiver employing radio frequency amplification, the grid bias is an important factor in the stabilizing of the set, as it allows the tube to operate at the proper point on the grid voltage-plate current characteristic curve.



The three-tube Inverse-Duplex circuit.

Correspondence from Readers

RE- "THE LATEST RADIO SWINDLE"

Editor, RADIO NEWS:

May I congratulate you on your timely article, "The Latest Radio Swindle"? That was a mighty wallop you handed friend Rogers, the "inventor" of the "Neurophonometer"! I believe also that that wallop will be but the beginning of a deserved series of same.

It was my good fortune, about two months ago, to witness this wonderful device in operation, or should I say, at play? The instrument was of an impressive nature with those mysterious radio attachments, the loud speaker with its little humming tune when the subject was properly "tuned in" and the inventor's recital of a recent successful issuance from a severe grilling before a "body of cold-blooded scientists." (The names of the scientific gentlemen were not given.) Though I am quite unfamiliar with the principles of radio, the inventor's unqualified statement that "nerve tissue was admitted to be the best conductor of electricity known" stimulated within my being what Hashamura Togo would call "my desire to know." To date I have been unable to verify this assertion. However, granting even Rogers' assumption that an electrical current does pass over nerve tissue alone by obligingly ignoring all other tissue, the intricate nerve connections would, of course, make such phenomena as he assumes to occur an impossibility.

There is a story about a chap who held down two jobs. During the day he worked in a law office, but at night he played a violin in a second rate orchestra. The lawyers, when asked as to his occupation, stated he was a musician, but the musicians all claimed he was a lawyer! For one, I would prefer not to classify Rogers as a chiropractor, for there has been more than enough exploitation of that inherently wonderful therapeutic measure ere this. Perhaps the fate of the Grecian gentleman of old, who, because of his perfidy, was disclaimed by both land and sea and hung in mid air, is most fitting.

You who deal in the easily demonstrable things of the physical world have a comparatively easy task when exposing charletans. In all branches of the healing art (surgery excluded) where knowledge is mostly of an empirical origin, such exposures are not always so easily accomplished, except in those cases, such as the one under consideration, wherein the imposter has inadvisedly stepped out too far and has exposed himself to a broadside from exact science.

By your exposé you have rendered a genuine service. A few such exposures of fallacies in general that more or less obtain in all schools of healing would be a very good thing. Especially for the poor drugged, serumized and kneaded public.

DR. G. A. FISK,
Pomona, Calif.

HIGH POWER BROADCASTING

Editor, RADIO NEWS:

Enclosed is the voting blank printed in the January issue of RADIO NEWS regarding "high power broadcasting." As you will notice, it is marked very emphatically "NO."

I'm not a BCL, I'm a Ham, and I want to see the development of radio continue in the great strides it has taken in the past few years. I've watched broadcasting from the time it was born as an experiment until now almost maturely an art. Regarding radio, I'm an egotist, and the thought of allowing greater power for broadcasting makes me want to yell.

Radio apparatus has been built with ideas of DX first, volume second, and quality third. With the present system of radio propagation, we have been able to tune with reasonable selectivity through the local transmitting stations and get the other one at a great distance. If we get a high power broadcaster, using the present system of tuning at the transmitting end, we can't get through their mush without an *ultrasuperhypotomaticneutor* using 15 R.F. and 2 A.F. and, though we may put 'em in, we can't afford 'em.

My station is 25 miles from WCX and WWJ; we have a Superdyne and get all the music we want from them. However, if we have a visitor or so we show off with a few DX stations. Enjoyment? Sure, lots of it. But, if WCX or WWJ increase power by two or three hundred per cent., even our sharp tuning Superdyne (no antenna at all) won't be able to get away from their side swings. And there are thousands in the same position.

40 Non-Technical Radio Articles

every month for the beginner, the layman and those who like radio from the non-technical side.

SCIENCE & INVENTION, which can be bought at any newsstand, contains the largest and most interesting section of radio articles of any non-radio magazine in existence.

Plenty of "How To Make It" radio articles and plenty of simplified hook-ups for the layman and experimenter. The radio section of SCIENCE & INVENTION is so good that many RADIO NEWS readers buy it solely for this feature.

List of Radio Articles Appearing in the March Issue of "Science and Invention"

Apartment House Radio
Tube Testers and How They Work
Elementary Radio Circuits
Chelmsford Radio Broadcast Station
Static and Other Noises in Radio Sets
European Broadcast Map
An Efficient Two-Tube Reflex Circuit
New Poratble Receiving Set
Radio Question and Answer Box
Latest News in Super-Hets
Radio Wrinkles

Perhaps the instigators of the super stations say that we should listen to the stations nearest us and appreciate their programs. In answer to this, I'll tell the world that we're Americans. The people of other nations are not, as a whole, given over to DX reception. They're easily satisfied and, consequently, we had to show 'em how to broadcast. Some decided to keep their "high loss" receivers and build bigger broadcasting apparatus to make up the difference between their broadcasting system and ours. We improved our receivers and get 1,000-watt stations 3,000 miles away with comparative ease.

Right now we're stuck on tuned R.F and Super-Hets, but before another year is over we'll have (if we continue with low power) receivers which, with one control, will tune out a 1,000-watt transmitter a mile away and get a five watter in S.A.

Should the government allow the superstations, we'll all become discouraged and commit radio suicide before new transmitting apparatus is designed to allow us to tune through. However, as a Ham, "I should care," but for "the folks," I'd like to suggest that the limits be set to 1,000 watts and let us increase the efficiency of our three and four tubes. We'll do it! Let the broadcasters worry about the quality of their music and voices, and, in return, we'll put their 1,000 watts further than it ever has gone, yes, consistently.

In conclusion, let me say that, if certain makers of radio receivers would make their coils of something other than No. 28 D.S.C. wire, we would have better results from stations of 1,000 watts, more than a few miles away. Yes, I've got one and I'm too tenderhearted to peddle it.

O. DE LOS UNDERWOOD, 8 BDR,
113 Pine Grove Ave.
Pontiac, Mich.

RECEIVES U. S. BROADCAST STATIONS IN SOUTH AFRICA

Editor, RADIO NEWS:

I am writing this letter to you to know if you will be good enough to assist me. Being President of the Transvaal Radio Society, out here in Johannesburg, South Africa, I am desirous of some information and fellowship, both for my society and myself. Firstly. Personally, I have succeeded in picking up your famous station KDKA on one single tube regenerative on an indoor antenna 22 feet long, also WJZ and WHAG, the latter two stations on a straight three-tube set of English design (one R.F., detector and one A.F.), and just recently several American amateurs, and the Naval Radio Laboratory sending tests on 54.3 meters. I want to know if there are any radio enthusiasts who would care to correspond and even exchange ideas. Personally, I find your American hook-ups superior to the English circuits and would like to know more about them.

Secondly. I can assure you your RADIO NEWS is looked forward to each month.

Thirdly. Have any of your radio fans picked up our broadcast station "JB"? It is a 500-watt Western Electric station working on 450 meters daily from 12:30 to 2 p.m., 4:30 to 6 p.m. and 6:30 to 10:30 p.m. Sundays, 8:45 to 10:30 p.m. We, over here, are seven hours ahead of you, so your chance would be our midday program.

L. C. HUGHES,
P. O. Box 3758,
Johannesburg, South Africa.

REGENERATIVE RECEIVERS AND NEUTRODYNES

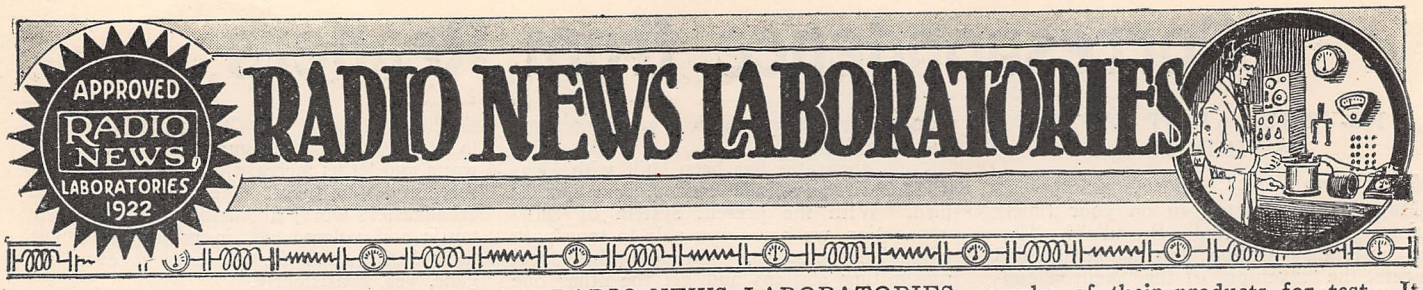
Editor, RADIO NEWS:

Kindly allow me to correct any erroneous impressions that may be gained by your readers due to the letter from Mr. Earnest appearing on page 947 of the December, 1924, issue of RADIO NEWS.

While criticisms are always welcome and the personal experiences of others in comparing different devices are always interesting, when any criticisms are made they should be confined to facts concerning the case.

In the first place Mr. Earnest greatly distorts the fifth paragraph of my article when he quotes me as saying the Neutrodyne is equal to a regenerator only on strong signals. The fifth paragraph of my article states that "the Neutrodyne will reproduce speech and music much more clearly than the usual types of receivers, and that fairly strong signals on a regenerative set will be *equally as strong* and much clearer on a Neutrodyne," and it surely takes a long stretch of the imagination to interpret this as Mr. Earnest does.

(*Continued on page* 1694)

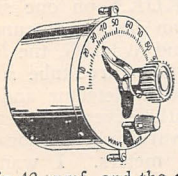


RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, it will be returned to the manufacturers with suggestions for improvements. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

Apparatus Awarded Certificates

JONES VARIABLE CONDENSER

The 23-plate variable condenser made by the Jos. W. Jones Radio Mfg. Co., 40 West 25th St., New York City, is furnished complete with a metal case and metal dial and pointer. It is designed for panel mounting. The minimum ca-

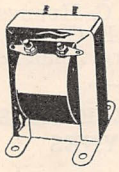


pacity is 42 mmf. and the maximum 600.08 mmf. The dielectric obsorption losses with the instrument set at maximum are equivalent to a series resistance of 77 ohms.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 657.

JONES AUDIO TRANSFORMER

For a small sized instrument this transformer works very well. The voltage amplification curve is very flat and extends well into the lower frequencies. An average amplification of three is obtained throughout a range of frequencies from 250 to

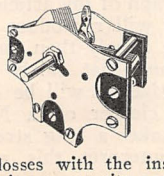


5,000 cycles. Thus the instrument will introduce very little distortion when used in a vacuum tube amplifier. Manufactured by the Jos. W. Jones Radio Mfg. Co., 40 West 25th St., New York City.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 656.

DANO VARIABLE CONDENSERS

These condensers are of simple and durable construction. They are manufactured by the Dano Radio Co., 69 Liberty St., Brooklyn, N. Y. The 23-plate grounded rotor type was found to have a minimum capacity of 16.8 mmf. and a capacity of 518.93 mmf. The dielectric ab-

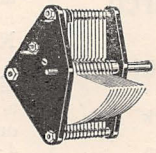


sorption losses with the instrument set at maximum capacity are equivalent to a series resistance of 30 ohms, at 1,000 cycles. The 13-plate insulated rotor condenser has a minimum capacity of 10.98 mmf. and a maximum capacity of 275.8 mmf. The dielectric absorption losses at 1,000 cycles are equivalent to a series resistance of 10 ohms. The illustration shows the grounded rotor condenser.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 664 and 665.

ELGIN VARIABLE CONDENSER

Although this condenser has insulated end plates it was found to have extremely low losses. With the instrument set at maximum capacity and tested at 1,000 cycles, the dielectric absorption losses are equivalent to a series resistance of 60 ohms. The minimum capacity is 14.03 mmf. and the maximum ca-



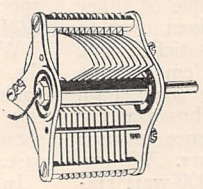
pacity 425.6 mmf. This is a 23-plate condenser manufactured by the Elgin Tool Works, Inc., 69 State St., Elgin, Ill.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 663.

FETT-KIMMEL CONDENSERS

The Fett-Kimmel Co., Bluffton, Ohio, submitted samples of their 13, 17, and 23-plate condensers which instruments were found to have the following characteristics:

Condenser	Capacity Min.	Capacity Max.	Equivalent Series Resistance
23 plate	14.03	473.18	25 ohms



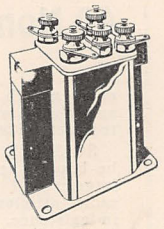
17 plate	12.20	353.40	50 ohms
13 plate	10.98	263.12	110 ohms

All tests were made at a frequency of 1,000 cycles.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATES OF MERIT NOS. 660, 661 and 662.

THORDARSON PUSH-PULL TRANSFORMERS

Where quality and volume are required in power amplifiers the push-pull system is usually employed. For this purpose an input and output transformer is used having center taps on the windings. The Thordarson input transformer gives an average voltage amplification of

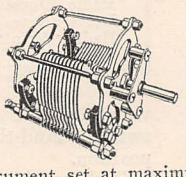


two each side of the center tap. The curve extends well into the lower frequencies and consequently all the notes of the musical scale will come through with excellent clarity. Manufactured by the Thordarson Electric Manufacturing Co., Chicago, Ill.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 651.

MAR-CO CONDENSER

This condenser is of excellent construction and its nickel plated framework gives it a highly finished appearance. It is of the grounded rotor type with pigtail connection. The 23-plate condenser has a minimum capacity of 13.42 mmf. and a maximum capacity of 525.03 mmf. The dielectric absorption losses with

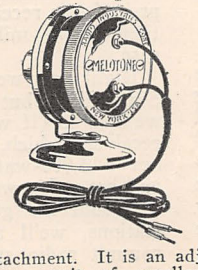


the instrument set at maximum are equivalent to a series resistance of 10 ohms. All tests made at 1,000 cycles. Manufactured by the Martin-Copeland Co., Providence, R. I.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 655.

MELOTONE PHONOGRAPH ATTACHMENT

Those who are in possession of a phonograph may use the excellent tone qualities of its horn in connection with their radio set by using

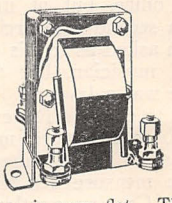


this attachment. It is an adjustable radiophone unit of excellent construction, mounted on a base as the illustration shows. It responds with very good volume throughout the entire audio frequency range and the absence of resonance harmonics makes reproduction very faithful and distortion less. Manufactured by the Radio Industries Corporation, 131 Duane Street, New York, N. Y.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 650.

MAR-CO AUDIO TRANSFORMER

This is a very well designed amplifying transformer having a 3½:1 ratio which checks very well with the voltage amplification tests made in our laboratories. The character-

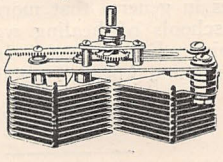


istic curve is very flat. The amplification is approximately 1¼ at 250 cycles and gradually increases to 4 at 5,000 cycles. The instrument does not have a tendency to howl or squeal as is the case with many high ratio transformers, and the quality of reproduction is excellent. Manufactured by the Martin-Copeland Co., Providence, R. I.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 654.

ENSIGN CONDENSER

This condenser is of a radically different design than the standard rotary plate type. Both sets of plates in this instrument are square as the illustration shows. The movable plates are moved in and out of the stationary plates by a rack and pinion arrangement that utilizes the



entire 360 degrees of the dial. The minimum capacity of this condenser is 5.99 mmf. and the maximum capacity is 539.06 mmf. The dielectric absorption losses at 1,000 cycles with the instrument set at maximum capacity are equivalent to a series resistance of 55 ohms. Manufactured by Carleton Sanders, Mishawaka, Ind.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 659.

KILLARK TRANSFORMER

This is a shielded transformer manufactured by the Killark Electric Manufacturing Co., Easton & Warne

Aves., St. Louis, Mo. The voltage amplification curve extends well into the lower frequencies and is very flat, indicating that the instrument introduces very little distortion. It operates with maximum efficiency between 1,000 and 3,000 cycles. An average voltage amplification of 5 is obtained.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 652.

MADERA CLEAR SPEAKER

This all-wood loud speaker is manufactured by the Compressed Wood Corporation, 345 West Austin Avenue, Chicago, Ill. The all-wood feature gives the speaker a very mellow tone. The phone unit is very

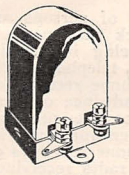
sensitive and faithfully reproduces broadcast music and speech. It responds with good volume throughout the entire audio range with a maximum volume in the neighborhood of 2,400 cycles.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 617.

PACENT TRANSFORMER

The Pacent audioformer No. 26 is of small size and entirely shielded. The voltage amplification varies from 3 to 250 cycles to 5½ at 5,000 cycles. Due to the fact that the instrument responds very efficiently at the lower notes of the scale, when used in a vacuum tube amplifier,

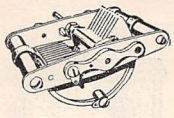


many of the musical notes that are missing when some transformers are used will come through with excellent clarity. Manufactured by the Pacent Electric Co., 91 Seventh Ave., New York, N. Y.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 653.

LINCOLN VARIABLE CONDENSER

This condenser is of excellent construction and is so designed that the three mounting holes are in line. It is of the grounded rotor type with pigtail connection. The 23-plate condenser has a minimum capacity of 10.98 mmf. and a maximum capacity of 518.32 mmf. The dielectric absorption losses at 1,000

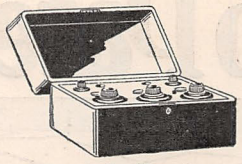


cycles with the instrument set at maximum are equivalent to a series resistance of 40 ohms. Manufactured by the Lincoln Radio 224 N. Wells St., Chicago, Ill.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 658.

DYNERGY RECEIVER

This receiver is complete in itself in that all that is necessary to place it in operation is to connect the plug to the 110 D.C. line. This lights the filaments and furnishes plate voltage supply. The set is a five-tube one employing two stages of tuned R.F. amplification, detector, and two stages of audio frequency amplification. The cabinet may be closed and locked. Although it operates from a lighting circuit, line



noises are entirely filtered out and the set is very quiet. Good results were obtained from this receiver in quality of reproduction, selectivity and sensitivity. Manufactured by the Dynamotive Radio Corporation.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 643.

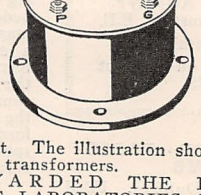
CUNNINGHAM TUBE

The Cunningham type C 301-A vacuum tube is of the standard construction with a few improvements such as a bakelite base instead of the usual porcelain and metal base. The filament consumes ¼ ampere at five volts. Plate voltages up to 150 may be used successfully. The amplification factor is between seven and eight, and the tubes work for a long time without losing their electronic emission or burning out. Careful manufacturing and inspection produces these tubes with uniform characteristics. Submitted by E. T. Cunningham, Inc., 182 Second St., San Francisco, Calif.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 670.

BALDWIN SUPER-HETERODYNE KIT

The Pacific Ranger Super-Heterodyne Kit manufactured by the Baldwin, Pacific & Co., San Francisco, California, comprises four intermediate transformers, oscillator coupler, and antenna coupler. One of the intermediate transformers is more sharply tuned than the others and serves as a filter coupler. They operate at a wave-length of 3,500 meters. The transformers are of the air core type. Although of simple construction, they were found very



efficient. The illustration shows one of the transformers.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 666.

DURHAM METALLIC GRID LEAK

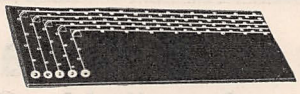
These grid leaks are made from a rare metal deposited on the inner or outer surface of a glass tube or rod insuring perfect and permanent resistance and noiseless operation. Of several samples submitted having various ratings these grid leaks were found to be accurate within 10 per

cent. They fit the standard grid leak receptacle. Manufactured by Durham & Co., Inc., 1936 Market Street, Philadelphia, Pa.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 667.

DURAD BASE

Radio set manufacturers and experimenters who build their own will find the Durad Base very convenient. It consists of a molded base board with the "A", "B", and "C" battery wires imbedded in it. The large number of holes along the wire allow for connections in many places. Special connectors, panel fittings, binding posts, and brackets are furnished with the baseboard. The set is, therefore, not only simple to wire and assemble, but it presents a commercial appearance when finished.

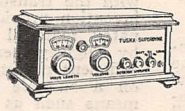


Manufactured in various sizes by the Duraplate Company, Summerdale Ave., near Roosevelt Blvd., Philadelphia, Pa.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 668.

TUSKA SUPERDYNE RECEIVER

The Tuska Superdyne receiver is manufactured by the C. D. Tuska Co., Hartford, Connecticut. This is a four-tube set employing one stage of tuned radio frequency amplification, detector and two stages of

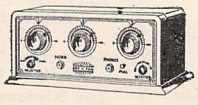


audio frequency amplification. The aerial and amplifier circuits are tuned with two condensers mounted on the same shaft. A small vernier condenser is connected in parallel with one of the condensers for more accurate adjustment. The tickler feed-back from the detector plate circuit is reversely coupled to the grid circuit so as to prevent oscillations. The set is very sensitive and selective. The quality of reproduction is good. It covers the entire broadcast wave-length range. Furnished in a large cabinet with plenty of space in the rear for batteries.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 645.

DAY-FAN RADIO RECEIVER

This receiver is of the tuned radio frequency type employing four

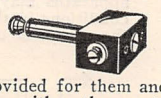


tubes and three tuning dials. It employs the "OEM" Duo-plex circuit and is equivalent to two stages of tuned R.F. amplification, detector and two stages of audio frequency amplification. It is non-regenerative and therefore does not radiate. The receiver tested was found very selective and sensitive. Manufactured by the Dayton Fan & Motor Co., Dayton, Ohio.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 644.

RADJO TELEPHONE PLUG

The outstanding features of this plug are its small size, and simple and durable construction. The telephone cord tips are inserted into the

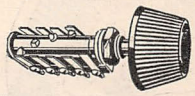


holes provided for them and securely clamped with the set screws. Manufactured by the Electric City Novelty and Manufacturing Co., 126 Odell Street, Schenectady, New York.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 649.

RADJO INDUCTANCE SWITCH

This inductance switch is of very novel design. The large knob turns a shaft on which there are five points located in a spiral path around it. On each side are five contact springs. By turning the knob one point at a time, contact is made with one spring, so that one complete

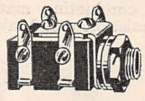


turn gives 10 separate contacts. The switch is small in size and silent in operation. Manufactured by the Electric City Novelty & Manufacturing Co., 126 Odell Street, Schenectady, N. Y.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 646.

RADJO JACK

This jack is designed for use with standard telephone plugs and varies from the well known types in construction in that it has side contact springs instead of the usual end contact springs. Thus the jack is much smaller in size than the usual

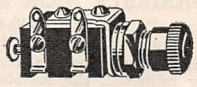


type. Manufactured by Electric City Novelty and Manufacturing Co., 126 Odell Street, Schenectady, New York.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 648.

RADJO SWITCH

This is a single pole double throw switch similar in construction to the Radjo jack described above. The small knob is pushed in and pulled out and the shaft makes contact with the side springs. The switch is small in size and silent in operation.

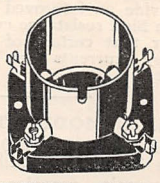


Manufactured by the Electric City Novelty & Manufacturing Co., 126 Odell Street, Schenectady, N. Y.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 647.

UNION VACUUM TUBE SOCKET

The No. VTSI vacuum tube socket manufactured by the Union Radio Corporation, 200 Mt. Pleasant Ave., Newark, N. J., has triple-spring contacts and molded shell and base. The socket is of very good electrical and mechanical construction and of pleasing appearance.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 642.

CALDWELL SOCKET

This socket is very small in size and has excellent side spring contacts. The type No. 201 socket fits the standard type 201 vacuum tubes. Its small size and small contact springs and connections make it desirable for use in receivers where space is of importance and where low distributed capacity is desired.

Manufactured by the Knox Corporation, Galesburg, Ill.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 611.

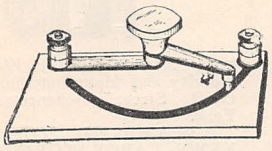
Digest of Latest Canadian Radio Patents

Compiled by G. F. SELLECK, Jr.

VARIABLE RESISTANCE

(Canadian Patent No. 240681, Thos. Appleby. Filed Feb. 14, 1924; issued June 10, 1924.)

In this invention the resistance element consists of a conducting material, preferably of high specific resistance and also non-metallic, such as

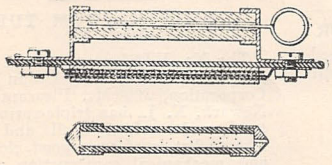


graphite, deposited upon or applied to a non-conducting base or support by passing over the base or support, sufficiently rough for the purpose, in contact therewith a mass of the conducting material which in effect makes a pencil mark upon the support, the pencil mark constituting the resistance element and the conducting mass later co-acting therewith, constituting the movable contact of the rheostat.

VARIABLE HIGH RESISTANCE

(Canadian Patent No. 240,611, C. E. Vawter. Filed June 27, 1923; issued June 3, 1924.)

This invention provides a resistance which may be easily adjusted, the resistance being of such a character that when it is adjusted to any given value it remains constant at that value. It also provides a variable high resistance unit of an improved construction, such that the resistance unit may be readily attached to the terminals of a grid condenser, thus providing a combined condenser and grid leak of improved construction and

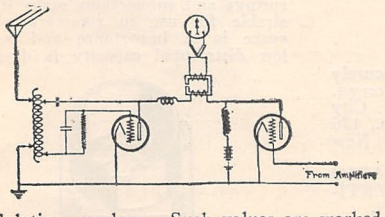


characteristics. A further object of the invention is to provide an improved wireless system having a variable high resistance connected therein in such a manner that certain of the high frequency or momentary currents are shunted through this resistance.

RADIO MODULATION SYSTEMS

(Canadian Patent No. 240,268, F. Conrad. Filed August 31, 1923; issued May 20, 1924.)

This invention provides a meter registering the alternating current component of the modulated current supplied to an oscillator tube, said meter being calibrated to indicate directly the ratio of the effective alternating current component to .7 times the steady direct current component. A further object of the invention is to provide a mechanism and a method of operation wherein the intensity of the modulation is controlled in accordance with a chart showing various average effective values of the modulating current or, in general, of the



modulation envelope. Such values are worked out with respect to the different kinds of sound being transmitted in such manner that the loudest individual units of the sound shall not, in general, cause the instantaneous intensity of modulation to materially exceed the value at which distortion from over-modulation begins.

TELEPHONE TRANSMITTER MOUNTINGS

(Canadian Patent No. 141,271, G. R. Lunn. Filed December 9, 1922 issued July 1, 1924.)

This invention provides a portable transmitter stand of simple construction, which will afford a transmitter maximum protection against major shocks and practically insulate it against minor vibrations, and at the same time be free from accoustical effects which would distort the sound waves. A stand is provided with an enclosure, in the center of which the transmitter may be resiliently supported, the enclosure having non-resonant and non-reflecting walls for affording protection to the transmitter without interfering with the transmission of the sound waves. The invention provides a drum-shaped cage of foraminated material such as metal screen reinforced by slightly heavier perforated walls to give it sufficient rigidity, the cage being mounted upright on a suitable base and provided with resilient means such as springs for supporting the transmitter centrally within the enclosure.

The Experimenter

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER.

Experimental Radio

Nothing but experiments, written by the foremost radio authorities, also a monthly editorial by H. Gernsback. A fine roto-gravure section to brighten up the magazine. But best of all for you radio readers, is the big radio section of over twelve pages of some fifty radio experimental articles—and mind you, NOTHING BUT EXPERIMENTS.

LIST OF INTERESTING ARTICLES TO APPEAR IN THE MARCH ISSUE OF THE EXPERIMENTER

Spectacular Tesla Experiments at the University of California. By Lester Reukema

The Klydonograph; Electric Surge Recorder

Experiments in Spontaneous Combustion By Earle R. Caley

Making and Using a Capillary Electrometer By Raymond B. Wailes

How Much Does Your Amplifier Amplify? By William Grunstein, E.E.

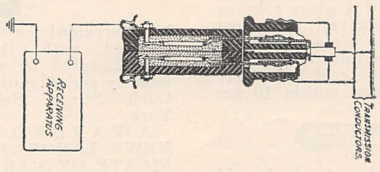
Lessons in Elementary Glass Working

THE EXPERIMENTER will be on sale at all newsstands February 20, 1925.

CONNECTING DEVICE FOR RADIO RECEIVING SYSTEMS

(Canadian Patent No. 241,752, W. Dubilier. Filed May 27, 1922; issued July 22, 1924.)

This invention provides a connecting device by means of which the circuit connections between the transmission conductors and the receiving apparatus may be readily altered to suit different conditions in the transmission line, and thus enable the currents of radio frequency to be effectively

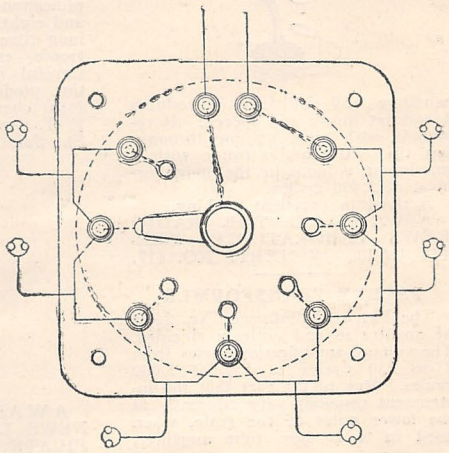


transmitted to the receiving apparatus. This device eliminates the possibility of improper circuit connections or by the exposure of the operator to the line of currents carried by the transmission conductors while permitting the currents of radio frequency to pass through the receiving apparatus.

RADIO TELEPHONE RECEIVER BLOCK

(Canadian Patent No. 240,556, W. G. Conger. Filed Oct. 18, 1923; issued June 3, 1924.)

The invention relates to a radio telephone receiver block for use in connection with radio receiving apparatus, and the invention provides a receiving block of such class with means whereby a plurality of telephone receivers can be connected with a radio receiving apparatus for use simul-

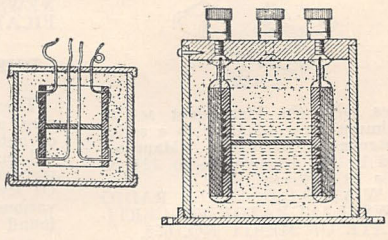


taneously by a plurality of persons and furthermore, to provide the block with means for successively cutting in or placing in circuit with the radio receiving apparatus, telephone receivers without cutting out the telephone receiver or receivers positioned in circuit in advance of the cutting in or closing the circuit for the subsequently connected receiver, or in other words providing means where one or more telephone receivers can be connected in circuit with a radio receiving apparatus without inconvenience when a change in the number of telephone receivers for use is desired.

TRANSFORMERS

(Canadian Patent No. 239,901, H. M. Lewis. Filed April 25, 1923; issued May 6, 1924. Assigned to Radio Service Laboratories, Inc.)

In this invention the winding or windings, depending upon whether it is a simple inductance or a trasformer, is supported on a tube of insulating material, such as vulcanized fibre, and embedded in a medium of more or less finely divided magnetic material, which in turn is contained in a suitable receptacle having a cover on which terminals, such as binding posts, are mounted—the ends of the winding or windings each being connected to a binding post. In such a structure the comminuted magnetic material may be in loose form, that is, no binder is necessary. The entire space within the receptacle, both inside and outside the tube, is filled with the comminuted mag-



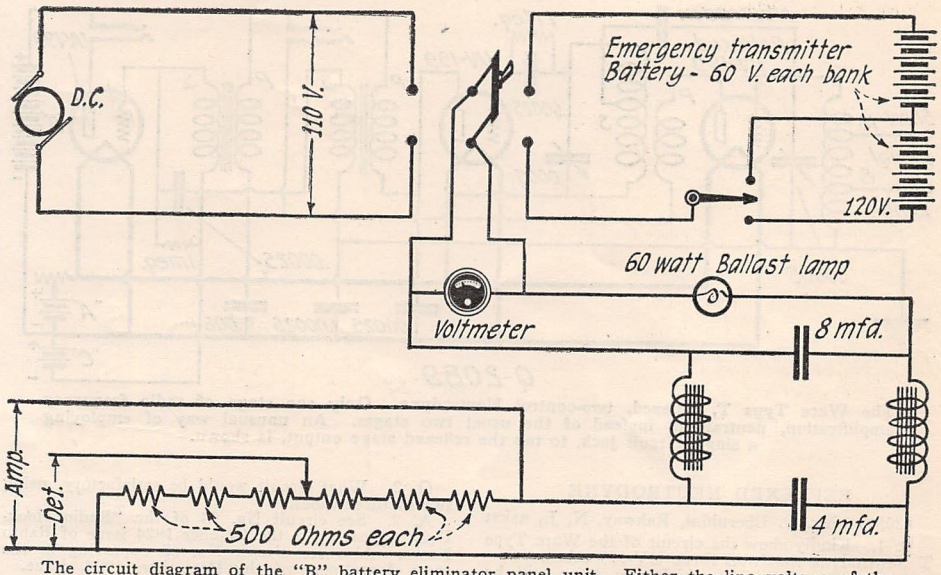
netic material and the latter is preferably pressed together sufficiently to hold the tube in a fixed position which is preferably in the center of the receptacle. It is not essential, however. that the comminuted magnetic material be under heavy pressure. A special feature of the invenuon provides a gap in the magnetic circuit where this is required. This is accomplished by inserting a disk of non-magnetic material of the required thickness in the supporting tube.

A New "B" Battery Eliminator Unit for U. S. Merchant Marine Vessels

By JACK BRONT

UTILITY, economy and efficiency have been the controlling factors in the development of a new radio unit for use aboard the merchant vessels of the United States Shipping Board. It was designed by Mr. Benjamin Wolfe, Radio Supervisor of the Pacific Coast for the Shipping Board, and developed by the Independent Wireless Telegraph Company.

For use with receiving apparatus, the unit has eliminated the necessity for the operation of "B" batteries in connection with detectors and amplifiers, and utilizes the free and abundant current available at the ship's light and power mains to serve the same purpose. Since it has been long desirable and plausible aboard ship to do away with "B" batteries, the new unit set will fill a long felt want. Especially on long voyages, "B" batteries are highly liable to disintegration and polarization—despite the fact that they are held as reserves and no current drained from them. Replacements at ports and stock depreciation elsewhere in warehouses or even aboard ship are eliminated and the ensuing economy and utility of the new unit accomplishes an advance over the old method of using the plate battery units.



The circuit diagram of the "B" battery eliminator panel unit. Either the line voltage of the ship's generator or the emergency transmitter storage batteries can be used for the "B" supply for the receiver.

THE EQUIPMENT

In detail, the mains leading to the unit are placed on the panel switchboard so that the voltmeter switch of the main set will connect across 60, and 120 volts of the emergency transmitter battery, or across the 110-volt line leading directly from the ship's generator. This gives a sufficient variation of voltages for introduction to the unit itself.

In series with one leg of the unit mains, a 60-watt lamp guards the apparatus from excessive current in the event of a short circuit, the ballast introduced in series, however, affecting the plate current in inconsequential degree.

Bridged across the unit mains beyond the ballast lamp is a battery of high capacity condensers, amounting to 8 microfarads. On each leg of the mains there are inserted the windings of a reaction coil of the filter type, and which are made specifically for use with the UV-1215 type of Kenotron.

Across the ends of the filter coils are connected high capacity condensers to total 4 microfarads capacity. From this point a main lead goes to the positive connection for the amplifier. Starting from the same point another lead connects to a series of six 500-ohm vitreous covered resistance units, each one incorporating a tap which leads to a terminal board.

The further end of the series resistance unit connects to the other side of the 4-microfarad condenser, thus shunting the whole series resistance unit across the main leads which emanate from the voltmeter switch on the main panel. From the same point the common lead for the detector and amplifier mains runs to the audion cabinet.

A lead from the positive connection for the detector tube may be adjusted at one of six different points on the terminal board, furnishing the following approximate voltages at the respective taps: 15, 25, 40, 50, 65 and 80 volts.

The unit, as a whole, is designed for wall mounting on a wood base and occupies a space of approximately 15x5x10½ inches, which space will be found in a convenient place on the bulkhead.

The condensers utilized in the unit are of the Kellogg type, and the vitreous resistances are manufactured by the Ward Leonard Company.

Using this unit, the variations in the potential from the ship's generator armature are efficiently smoothed out so as to be absent, even though six stages of amplification are employed in reception, thanks to the careful design and development of the unit.

Such improvements as those of the type illustrated herewith are highly welcome aboard ship and tend to make the operator more efficient and traffic more dependable in the important business of carrying on the correspondence of the nation's merchant fleet. It is hardly necessary to point out that, while radiophone developments are going forward with leaps and bounds to satisfy the enormous demands of the enthusiastic radiophone public, nevertheless developments, improvements and new departures are being daily added to commercial radio telegraphic apparatus for the control and guidance of merchant vessels and land stations, upon which former vessels depends a great part of the prosperity of the nation, due to the status of imports and exports. Our ocean freighting fleets are, all in all, equipped with the finest and most efficient radio telegraphic apparatus of the entire world, thanks to the untiring efforts of wireless companies and merchant fleet officials to promote, maintain and adopt the newest in apparatus of every description.

This Union Business

By HOWARD S. PYLE

SOME of us have watched with amusement the increasing frequency of letters to the editor and bold suggestions in articles relative to the possibility of reviving the old United Radio Telegraphers' Association, or the formation of a new organization with similar purposes. It would appear that this is more or less idle chatter and outside of some agitation accomplishes no useful purpose. If commercial radio telegraphers really are desirous of an organization to protect their interest (and it is sadly needed), why not lay the cards on the table, dig up a few strong-willed leaders who are capable of making at least a start in organizing the fraternity, and make an honest effort to accomplish more than just an expressed desire for organization?

Just by way of starting a train of thought, and it is hoped, possible action, I would like to present the following facts relative to the organization in effect among the Canadian radio telegraphers which has satisfactorily accomplished its purpose since October 1, 1923. While probably as a whole it is not entirely acceptable to the American commercial radio telegrapher, the outline of the agreement existing between our Canadian cousins, their employing company and the Commercial Telegraphers' Union of America should certainly offer an excellent working basis for the American operator to use as a foundation.

CANADA'S PLAN

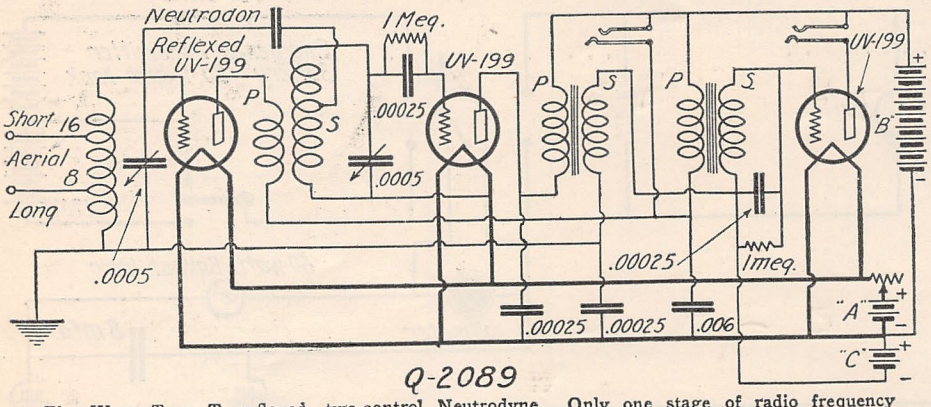
The Canadian agreement is between the Marconi Wireless Telegraph Company of Canada, Ltd., and the Commercial Telegraphers' Union of America. This, of course, would not work out in the United States,

(*Continued on page* 1702)

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions ror the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.



Q-2089

The Ware Type T, reflexed, two-control Neutrodyne. Only one stage of radio frequency amplification, neutralized, instead of the usual two stages. An unusual way of employing a single circuit jack, to tap the reflexed stage output, is shown.

REFLEXED NEUTRODYNE

(2089) Mr. P. Cherubini, Rahway, N. J., asks:

Q. 1. Kindly show the circuit of the Ware Type T Neutrodyne that uses three UV-199 tubes.

A. 1. The circuit to which you refer will be found in these columns. Standard neutroformers may be used. A very satisfactory unit for coil "A" may be made by winding 45 turns of No. 22 D.C.C. wire on a three-inch tube. This coil may be tapped eight and 16 turns from the filament end. Unit "B" may be made by winding 50 turns of the same size wire on another tube of the same size. One or two layers of Empire cloth are wound over this secondary winding (a tap for the neutralizing condenser connection may be taken about 20 turns from the filament end of this coil), and over this, near the filament end, is wound the primary which may consist of about 16 turns of the same size wire.

The first radio frequency tube is reflexed and the out-put of this tube is tapped by the jack connected to the primary of the last audio frequency transformer. The out-put of the three tubes is secured by plugging into the jack in the plate circuit of the last tube.

This set is designed for best operation with UV-199 tubes. It is necessary that the two inductances be placed in non-inductive relation to one another and that extreme care be taken in the construction of the set, in order to keep the coupling between wires and instruments at a minimum.

Poor results will be experienced if standard sockets are used with adapters; low capacity, UV-199 sockets are required.

A reflexed Neutrodyne is a difficult receiver to construct without factory facilities.

Q. 2. Referring to the "Z", circuit on page 687 of the November, 1924, issue of Radio News. Kindly check these values. C-1, C-2 and C-4, .0005 mfd. variable condensers in shunt to spiderweb or lattice wound coils of the Journal One-Knob, or Freshman variety; C-3, .0005 mfd.; C-5, .00025 mfd.; Resistance R, one megohm; R-1, two megohms.

A. 2. The above constants will be satisfactory for experimenting to determine the values most suitable for your particular conditions.

Q. 3. Can an air core transformer with a ratio of 1:1, with the secondary tuned by a variable condenser, be used as windings, L-2, L-3, L-4 and L-5?

A. 3. We believe that such construction would cause strong oscillation, due to too many turns in the primaries. The construction described in the answer to the first question will probably be found suitable.

SHORT WAVES

(2090 Mr. Morris H. Clayton, Philadelphia, Pa., asks:

Q.1. Would you recommend using a Gen-Win short wave coupler for the reception of stations around 100 meters?

A. 1. This coil should prove satisfactory.

Q. 2. What circuit would be satisfactory, using two or three tubes.

A. 2. See circuit No. 54 of the "Radio Hook-Ups" appearing in the October 1924 issue of Radio News. Also see circuit No. 67 appearing in the same department of the December, 1924, issue.

Q. 3. What is the winding formula?

A. 3. Primary, six turns; secondary 14 turns and tickler 16 turns. The secondary is shunted by a condenser of about .0005 mfd. capacity. The primary is in solenoid form. The primary is bare No. 14 wire silver plated to prevent corrosion. The secondary is No. 18 D.C.C. wire, stagger wound. The tickler is No. 18 D.C.C. wire spiderweb wound.

NON-OSCILLATING REGENERATIVE SET

(2091) Mr. E. Bonavia, Victoria, B. C., asks:

Q. 1. Several times of late I have been listening to the local broadcast station with a crystal tuner, and while they were standing by with the generator running I have been able to tune in distant broadcasting stations and C.W. signals quite distinguishable that I could not hear before. Is my crystal oscillating? If so could you kindly explain how this happens?

A. 1. The reception you mention may have been the result of several causes. The operator at the broadcast station whose duty it is to keep a constant watch by listening in with a receiving set, may have been tuning to the stations you heard. A re-radiation of these signals may have been picked up by the transmitting aerial and superimposed on the carrier wave emanating from the transmitting antenna. We do not believe your crystal was oscillating.

Receiving sets in your neighborhood sufficiently close to effect your antenna may have been tuned to signals you heard, and re-radiated to your aerial. C.W. signals radiated by local oscillating receivers may be heterodyning with the transmitting station waves you mention, producing a beat which would be audible when rectified by your crystal detector.

Is it not possible that the signals which you refer to as being those of a continuous wave transmitter, may have been the signals of a station transmitting I.C.W. (interrupted, continuous waves)?

Q. 2. How is a pickle bottle coil constructed?

A. 2. The construction of these coils is described on page 1178 of the January, 1925, issue of Radio News.

Q. 3. Is it possible to construct a non-radiating regenerative receiver?

A. 3. It is possible to construct regenerative receivers that will radiate only from the inductances and not from the aerial. The entire system is thoroughly described in the article "Non-Radiating Regenerative Receivers," on page 496 of the October, 1924 issue of Radio News.

SUPER-REGENERATION

(2092) Mr. Boyd Wilson, Toledo, Ohio, asks:

Q. 1. Do double grid tubes operate as well as single grid tubes?

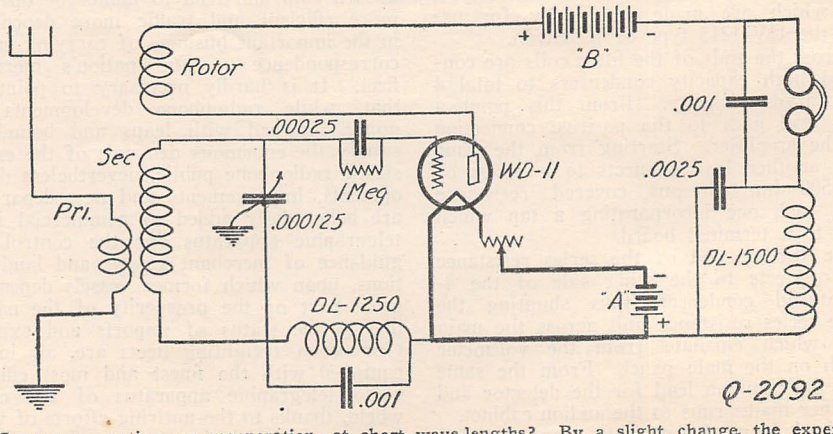
A. 1. In the main, no. There are circuits where double grid tubes are of greater value than single grid tubes. The principle of the double grid tube is correct, but the great majority of these tubes are not made as perfectly as the three element tubes. The special construction of the better known three element tubes is not available to the present manufacturers of four element tubes.

For experimental purposes, the available four element tubes will usually be found satisfactory.

Q. 2. Is it possible to use Super-Regeneration on the short wave-lengths?

A. 2. It has been found that Super-Regeneration on the short wave-lengths seems to be a considerably better proposition than Super-Regeneration on the regular amateur or broadcast wave-lengths. The standard circuit will be found in these columns. The circuit used is that of the standard regenerative receiver with the addition of the coils DL-1250 and DL-1500, with their accompanying capacities. These two honeycombs are in variable inductive relation. When receiving short wave-lengths between 50 and 110 meters for the primary, six turns of No. 20 D.C.C. wire wound directly over the secondary will be satisfactory. The secondary may consist of about 15 turns of No. 24 D.C.C. wire wound on a three-inch form. It will be advisable to use some special form of low loss winding, such as the pickle bottle, spiderweb, honeycomb, lattice, or Morecroft type.

The winding method for the latter form of coil



Q-2092

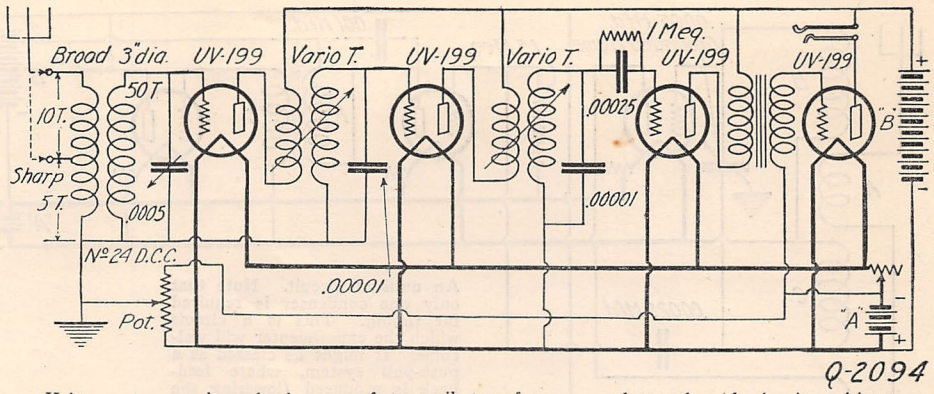
Super-regeneration, or regeneration, at short wave-lengths? By a slight change, the experimenter has either available, at will. We will welcome reports, addressed to this department, on reception conditions in various parts of the world, at short wave-lengths.

is similar to that shown on page 55 of the July, 1924, issue of RADIO NEWS. However, the method of using insulating strips should be applied to the secondary winding as well as to the primary winding. The tickler may be wound on a solid tube in a manner similar to the primary coil construction shown in the above mentioned article.

An amplification of this circuit will be found on page 32 of our contemporary magazine, *QST*, for October, 1924.

Q. 3. Is it possible to use a .0005 mfd. grounded-frame condenser, to eliminate capacity effect, as the oscillator condenser of the Tropadyne, instead of the usual .001 mfd. variable condenser?

A. 3. Yes. Instead of the usual 20 to 24 turns of No. 20 S.S.C. wire, for the plate, and 29 turns for the grid (3" tube), use 20 turns of No. 24 S.S.C. wire in the plate and 51 turns in the grid. Tap in the center. A standard two-coil (or a three-coil, if the primary is left unconnected), variocoupler may be used with increased efficiency. The fixed resistance should be between ¼ and ½ megohm.



Voltage step-up through the use of two-coil transformers, and tuned grid circuits without condensers, are outstanding features of this receiver. Loud speaker reproduction of local signals, and loud headphone reproduction of very distant stations, using only dry cell tubes, is had.

FINE SUPER-HETERODYNE RESULTS

(2093) Mr. Joseph Anvil, Oxford, Ohio, asks:

Q. 1. What would be considered good operation of a Super Heterodyne?

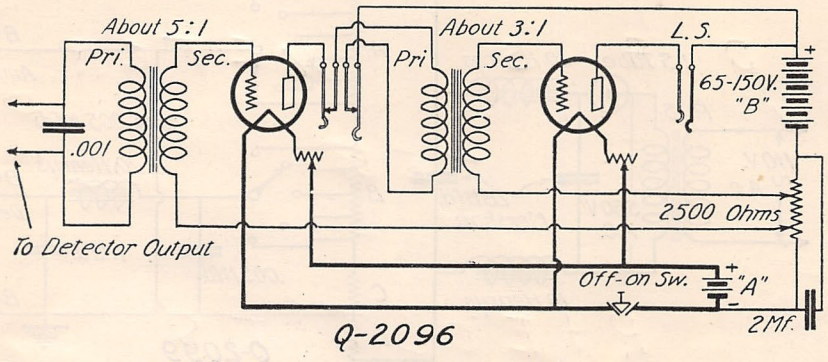
A. 1. It is difficult to answer your question. Location, regardless of the set used, is a very important factor in determining the results with a set. We should say it was functioning satisfactorily if a set employing three stages of intermediate frequency amplification will operate the loud speaker on only the detector, when only a coil three inches in diameter is used as the pickup device, receiving the signals from stations located within a radius of 100 miles and having a power of about one K.W. Also, it should be possible to operate the loud speaker so that signals are clearly understandable in a large room, using a loop aerial about two feet in diameter, receiving the programs broadcast by a 1 K.W. station 1,000 miles away, using only the detector output preceded by three stages of intermediate frequency amplification. No aerial or ground should be used for this test.

Q. 2. What is the color code of Rasco radio frequency transformers?

A. 2. Blue, outside primary; red, inside primary; orange, outside secondary; green, inside secondary.

Q. 3. Does it make any difference, at amateur or broadcast wave-lengths, whether the variable condenser across an inductance is connected close to the inductance, or some distance from the inductance, granting that mechanical reasons make it necessary to place the coil at a greater-than-usual distance from its two connections to the tube?

A. 3. It would be more desirable to place the condenser at the greatest distance from the coil, so as to include as much of the coil leads in the oscillatory circuit tuned by the condenser, as possible. Otherwise, high frequency parasitic oscillations may be generated by reason of the inductance and capacity furnished by the leads not included in the tuned circuit. The effect of these oscillations is not always noticeable. The shorter the wave-length, the more pronounced these effects become. In transmitting circuits, these oscillations are often easily detectable, where the above precautions have not been taken, sometimes causing inoperation of the set.



"C" battery potential, but no "C" battery. Seemingly paradoxical, explained by the resistance in series with the "B" battery supply. The voltage drop is at negative potential.

NEUTRODYNE DATA

(2094) Mr. Franklin J. Angevine, Dayton, Ohio, asks:

Q. 1. What is the diagram of connections employed in the Boonton Light Four receiving set (portable)?

A. 1. The circuit of this set will be found in these columns. UV-199 tubes are used throughout. Ballentine variotransformers are used in place of the usual fixed transformers. These transformers are so constructed as to be variable in wave-length in a manner similar to the variometer. The primary is in two parts, as is the secondary. One-half of each winding is variable in inductive relation to the remaining half. This enables the determination of opposing or assisting fields, resulting in a wave-length control. These transformers are varied in conjunction with the tuning condenser. By the use of these transformers, high amplification is had at one desired wave-length, without the usual requirement of considerable space for variable condensers.

Although no condenser is shown, it might be advisable to shunt a .001 mfd. fixed condenser across the primary of the first audio frequency transformer.

This circuit may be used to include any make of fixed radio frequency transformers, although results will not be as good as when the secondaries are tuned in some manner. If desired, standard air-core radio frequency transformers designed to be tuned by means of shunt variable condensers may be used in place of the two Variotransformers.

The aerial tuning transformer may be of standard type. A regular variocoupler would be satisfactory. The primary may be untuned, as shown, or not, as personal wishes dictate.

The weight of the outfit, with batteries and all, is in the neighborhood of 20 pounds.

Q. 2. Is there any way of increasing the efficiency of a Neutrodyne that is neutralized and functioning well, without adding tubes?

A. 2. Try connecting a crystal detector in the lead to the grid of the detector tube. A fixed crystal detector, known to be sensitive, would be the most convenient to use. Some experimenters find that a fixed condenser in series with the aerial will improve the quality of reception, even though the primary is untuned; the value is in the neighborhood of .006 mfd. capacity.

If the radio frequency stages are connected to the same rheostat as the detector or audio frequency stages, better results will be had, although it increases the number of controls, by using a separate rheostat for the radio frequency tubes; one rheostat will be sufficient. A 20-ohm one will be satisfactory.

Locals will be received with less distortion and less interference, if the first radio frequency tube is removed from the socket. All sets will not respond to this treatment, but most sets will. If separate rheostats are used for each radio frequency stage, the filament of the first tube may be "turned out". Distant stations are seldom heard with this arrangement.

Do not forget the by-pass condenser from the plate of the detector tube, to "A" minus; .05 mfd. is usually about right. A resistance variable between 25,000 and 250,000 ohms, in shunt to the secondary of the first or second audio frequency transformer often improves the quality of amplified signals, in addition to acting as a volume control. This is due to the imposed load being controlled and adapted better to the conditions of the particular amplifier used.

Q. 3. What is "Toll Broadcasting"?

A. 3. Broadcasting by rental agreement. Some stations charge a definite sum for a definite period, for the use of the broadcasting station and its personnel.

CONDENSER DATA

(2095) Mr. G. H. Lynch, Plano, Texas, asks:

Q. 1. What is a "grounded frame" condenser?

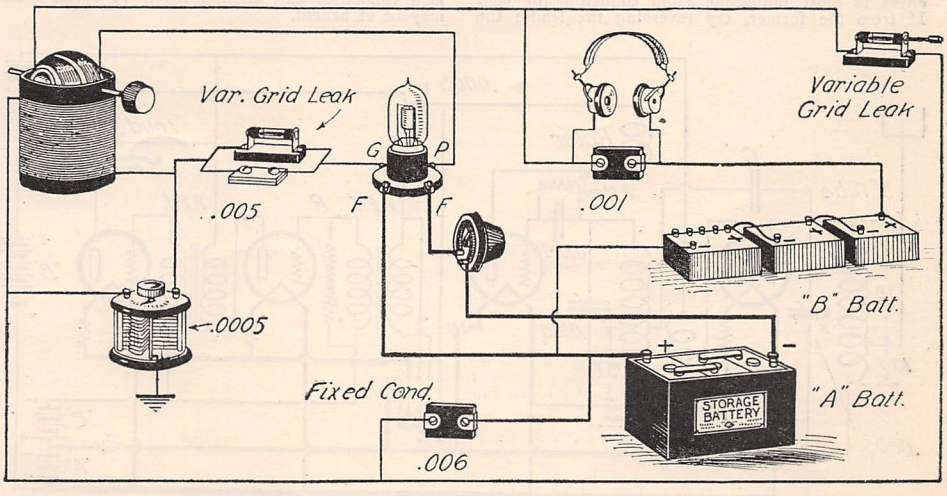
A. 1. A condenser having both movable and fixed plates entirely insulated from the frame. The frame may thus be grounded, without materially affecting the operating characteristics of the condenser. If the frame is connected to the point of lowest potential, no capacity effect is possible.

Q. 2. What is a "grounded rotor" condenser?

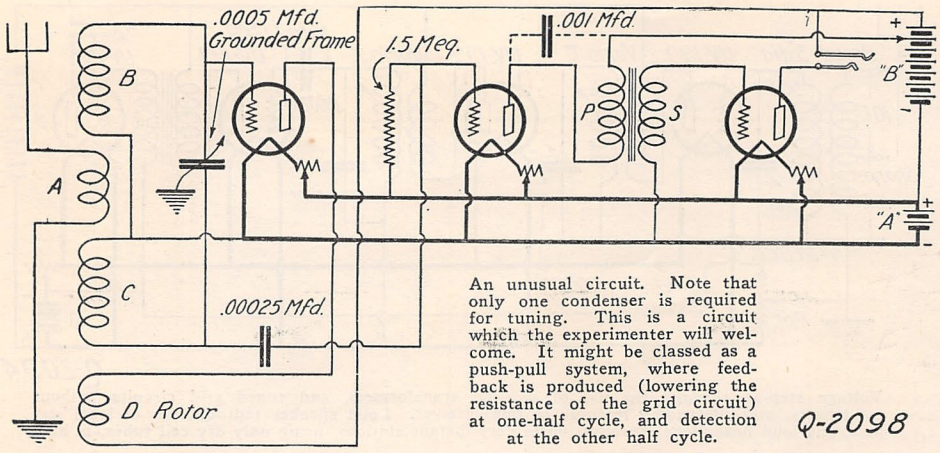
A. 2. A condenser whose movable plates are connected to the frame. The capacity effect possible is governed by the circuit, since it is not possible to place the frame at a potential lower than the potential of the movable plates.

Q. 3. What is the "square law" of variable condensers?

A. 3. That the change in capacity is directly



The latest Flewelling circuit. The frame of the variable condenser, insulated from both sets of plates, is grounded. Thus hand-capacity, otherwise present, is eliminated. It is essential that very efficient variable leaks be used.



An unusual circuit. Note that only one condenser is required for tuning. This is a circuit which the experimenter will welcome. It might be classed as a push-pull system, where feedback is produced (lowering the resistance of the grid circuit) at one-half cycle, and detection at the other half cycle.

proportional to the change in the relation of the movable and stator plates.

TWO NEW CIRCUITS

(2096) Mr. Manuel Smith, Plainfield, N. J., asks:

Q. 1. Is it not possible to use the "B" battery to supply a "C" potential?

A. 1. The method is shown in these columns. At first glance, one is inclined to believe that the potential applied to the grids will be positive in polarity but a little study of the circuit will show that this is not true. The by-pass condenser is quite essential. A common "A" battery may be used, but it is advisable to use a separate "B" battery.

Q. 2. What is the new Flewelling circuit?

A. 2. This circuit will be found in this department. It is essential that resistance "R" be smoothly variable over a wide range. A Bradleyleak will be particularly suitable. A Turnit would also be satisfactory, in some cases. Hand-capacity is very pronounced, when adjusting the value of this leak. For that reason the unit should be so placed and mounted as to be adjustable through an insulating control rod.

Since both the movable and stator plates of the variable condenser are at higher-than-ground potential, capacity effects will be very objectionable, when tuning in, unless grounded-frame condensers are used, or some form of remote control of the standard type of condensers is possible.

No aerial and ground are used with this set.

The rotor and stator of the tuning unit both contain 50 turns of wire. A low-loss form of winding is very necessary. Two 50-turn spiderwebs will be satisfactory, one being in variable inductive relation to the other.

Note the large size of the detector grid conconder.

A continuous, high-pitched whistle should be heard when the set is operating properly. This is the "variation frequency" characteristic of superregenerative receivers. Since no aerial and ground are required, radiation from this receiver is very slight.

HAND CAPACITY

(2097) Mr. Martin W. Allison, San Angelo, Texas, asks:

Q. 1. I have a home-made regenerative receiver, using a Peerless coil. A zinc shield is used. How can extreme body capacity be eliminated?

A. 1. You do not state whether the capacity effect is most noticeable from condenser or coil. If from the former, try reversing the leads; the rotor plates should connect to the point of lowest potential (usually the filament). If from the latter, try reversing the leads to the coil rotor. Try grounding the filament circuit. It may be advisable to use a grounded-frame condenser.

Q. 2. Using a WD-12 tube in a Cockaday circuit, the range seems to be narrow, as only KFKX can be heard; how can the range be increased?

A. 2. That question, too, is not definite. The 23-plate condensers you are using should result in quite sufficient wave-length range, unless one or both condensers short-circuit at some positions of the plates. Test for this by means of the usual battery-headphones-condenser series connection. You may have a poor tube. Try it in a standard regenerative circuit. If more than a single dry cell has been connected to the tube (the cells being in series), your tube has probably lost its property of filament electron emission. Leaving the tube lit for a few hours, with the "B" battery disconnected, may restore the tube to its former standard of performance, but we doubt it.

Due to the slight amount of data furnished, we find it most difficult to determine just why your set does not perform more satisfactorily.

Vary the plate potential. Finally, try another grid condenser and another leak. A variable one may be of benefit.

Q. 3. Would a UV-199 tube function better in the above circuit?

A. 3. Not unless your trouble is tube trouble. Tube for tube, we do not believe you would find much difference between the operation of either tube, as a detector, in the Cockaday circuit, if both vacuum tubes are good.

AUGMENTOR CIRCUIT

(2098) Mr. Lee W. Gaines, Steubenville, Ohio, asks:

Q. 1. What system of connections is used in the "Augmentor" circuit of Francis Hoyt?

A. 1. The diagram of conenctions is shown in this department.

On a tube three inches in diameter wind 12 turns of No. 20 D.C.C. wire, to form coil "A". Coils "B" and "C" are about the same, viz: 25 turns of No. 22 or No. 24 D.C.C. wire wound on the same tube as primary "A". Coils "B" and "C" are placed either side of coil "A", but separated about one or two turns. Rotor "D" may consist of a spiderweb or a cylindrical winding of about 30 turns, on a tube 2¼ to 2½ inches in diameter.

Since both the movable and stator plates of the variable condenser connect to points of high potential, it is not possible to eliminate hand capacity by grouding any part of the ordinary variable condensers. Grounded rotor condensers are no different, in this respect. Grounded frame condensers, however, will be entirely free from capacity effect.

Although not shown in the original diagram, it may be advisable to connect a variable condenser of .001 mfd. capacity across the primary of the first audio frequency transformer, as shown by the dotted lines.

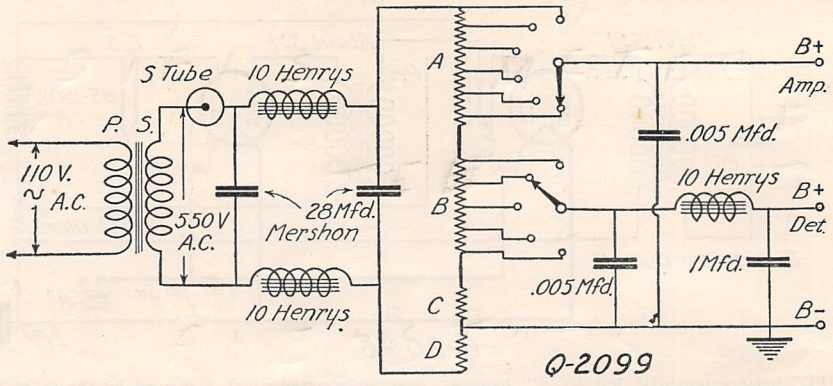
This circuit resolves itself into one stage of tuned radio frequency amplification, detector, and one stage of audio frequency amplification, with variable coupling (the rotor) between the radio frequency tube and the detector.

Q. 2. Would there be an increase of volume by using direct aerial coupling, instead of inductive coupling?

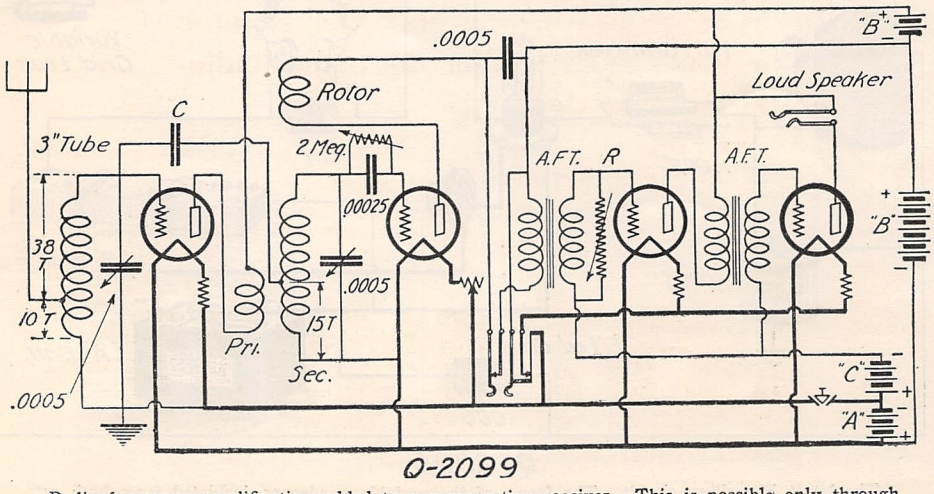
A. 2. Yes. But tuning would be more broad.

Q. 3. Why are not Neutrodyne receivers on the market having three, four or five stages of radio frequency amplification?

A. 3. The construction of such sets has been accomplished in the laboratory, but there are too many variable elements to make such a set a successful commercial proposition. This is in addition to the greater difficulty of quickly adjusting the additional tuning dials, were one dial retained to tune each stage of radio frequency amplification.



A standard current supply circuit. Plate voltages up to about 100 are obtainable. The parts, being in limited demand, are not purchasable in most radio stores, but can be obtained from the larger companies.



Radio frequency amplification added to a regenerative receiver. This is possible only through extremely careful design and construction. This circuit shows how to do it. There are other features to this circuit, the Browning-Drake, as well.

"B" SUPPLY VIA "S" TUBE

(2099) Mr. James Nall, Washington, D. C., asks:

Q. 1. Can an "S" tube be used in a circuit for supplying "B" potentials for detector and amplifier?

A. 1. We are showing a circuit employing the Amrad "S" tube, and Mershon electrolytic condensers of very high capacity. Resistances "A", "B", "C" and "D" total 19,900 ohms. Unit "A" consists of six resistances, each of 1,400 ohms. Unit "B" consists of four resistances, each of 125 ohms. Unit "C" is 1,000 ohms and unit "D" is 10,000 ohms. Lavite resistances should be entirely satisfactory. Any inquiries on this circuit should be accompanied by a stamped return envelope.

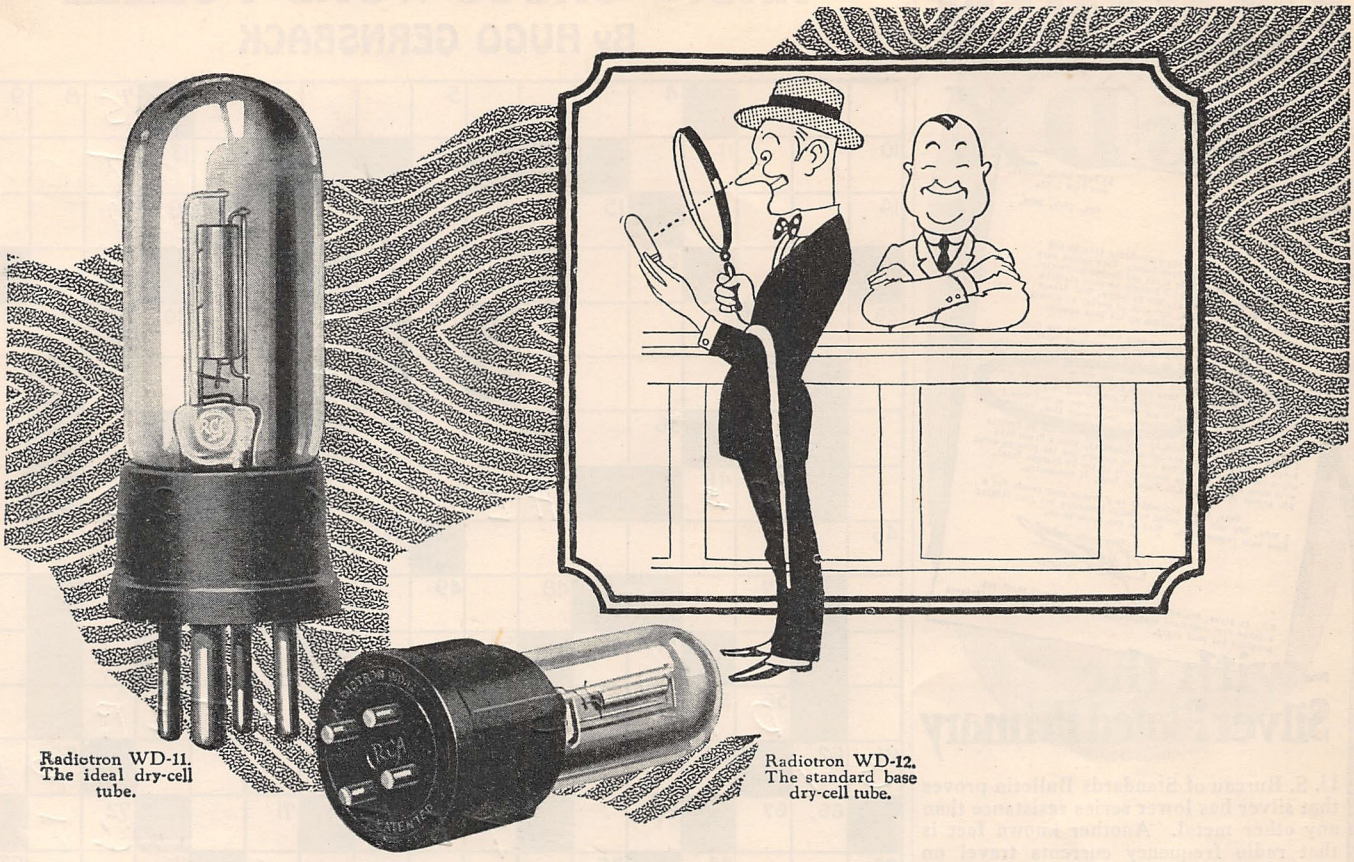
Q. 2. What is meant by the expression, "directing traffic"?

A. 2. The "traffic" referred to is the code messages transmitted and received by commercial and amateur operators. Anyone appointed to determine the most expeditious method of disposing of the messages received and transmitted by the various stations, is spoken of as "directing traffic".

Q. 3. What is the Browning-Drake circuit?

A. 3. The Browning-Drake circuit, shown in these columns, is seen to incorporate one stage of

(*Continued on page* 1760)



Radiotron WD-11. The ideal dry-cell tube.

Radiotron WD-12. The standard base dry-cell tube.

For *Distance* — the *tube* is important

Radiotrons WD-11 and WD-12 are the same except for the base.

Radiotron WD-12 has a standard navy type base. Use it to change your set to dry battery operation. Ask your dealer today.

This symbol of quality is your protection

Radio reception is not only a question of power, but of sensitivity to weak signals—and *clear* amplification. Radiotrons WD-11 and WD-12 are sensitive to the extremely feeble signals from distant stations—are silent in operation—and economical. They are famous for radio frequency amplification as for audio frequency—and detection. Get *genuine* WD-11's or WD-12's. Look for the name Radiotron and the RCA mark.

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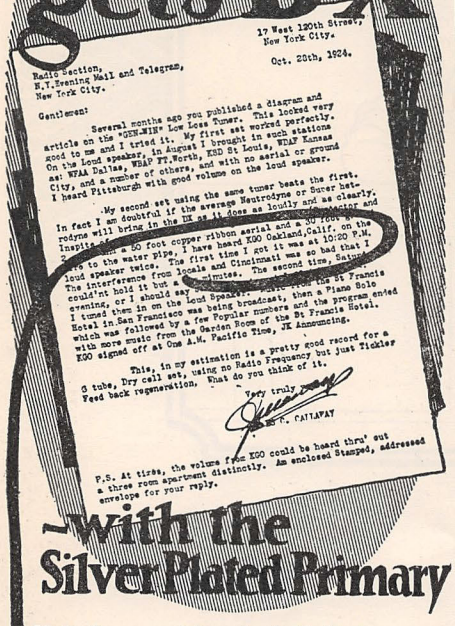
GEN-WIN gets DX


17 West 120th Street,
New York City.
Oct. 20th, 1924.

Radio Section,
N.Y.Evening Mail and Telegram,
New York City.

Gentlemen:

Several months ago you published a diagram and article on the "GEN-WIN" Low Loss Tuner. This looked very good to me and I tried it. My first set worked perfectly. On the Loud speaker, in August I brought in such stations as: WFAA Dallas, WBAP FT.Worth, KSD St Louis, WEAF Kansas City, and a number of others, and with no aerial or ground I heard Pittsburgh with good volume on the loud speaker.

My second set using the same tuner beats the first. In fact I am doubtful if the average Neutrodyne or Super hetrodyne will bring in the DX as it does as loudly and as clearly. Inspite of using a 50 foot copper ribbon aerial and a 30 foot wire to the water pipe, I have heard KGO Oakland,Calif. on the loud speaker twice. The first time I got it was at 10:20 P.M. The interference from locals and Cincinnati was so bad that I could'nt hold it but a few minutes. The second time, Saturday evening, or I should say Sunday morning, at 1:30 A.M. from the St Francis Hotel in San Francisco was being broadcast, then a Piano Solo I tuned them in on the loud speaker. The program ended with more music from the Garden Room of the St Francis Hotel. which was followed by a few Popular numbers and the program KGO signed off at One A.M. Pacific Time, JK Announcing.

This, in my estimation is a pretty good record for a 3 tube, Dry cell set, using no Radio Frequency but just Tickler Feed back regeneration. What do you think of it.

Very truly yours,
H.C. CALLAWAY

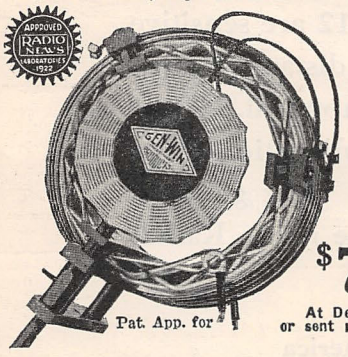
P.S. At times, the volume from KGO could be heard thru' out a three room apartment distinctly. An enclosed Stamped, addressed envelope for your reply.

~with the Silver Plated Primary

U. S. Bureau of Standards Bulletin proves that silver has lower series resistance than any other metal. Another known fact is that radio frequency currents travel on the surface of wire. Therefore, if surface conductivity is increased, the set employing the wire will be made more efficient.

GEN-WIN Low Loss Tuner employs an aperiodic primary of special silver plated copper wire. Condenser tuned secondary and self supporting spiderweb tickler are also of latest low loss design. A GEN-WIN Low Loss Tuner will enable you to build the most efficient reflex or regenerative set ever designed, both for DX and local reception. They are unconditionally guaranteed.

With each tuner you get a complete set of detailed blueprints (full size panel pattern, instrument layout and picture wiring diagram) for latest Gen-Win Low Loss Set. Separately 50c. Write for descriptive circular, Dept. RN 325.



Pat. App. for

$7.00

At Dealers or sent postpaid.

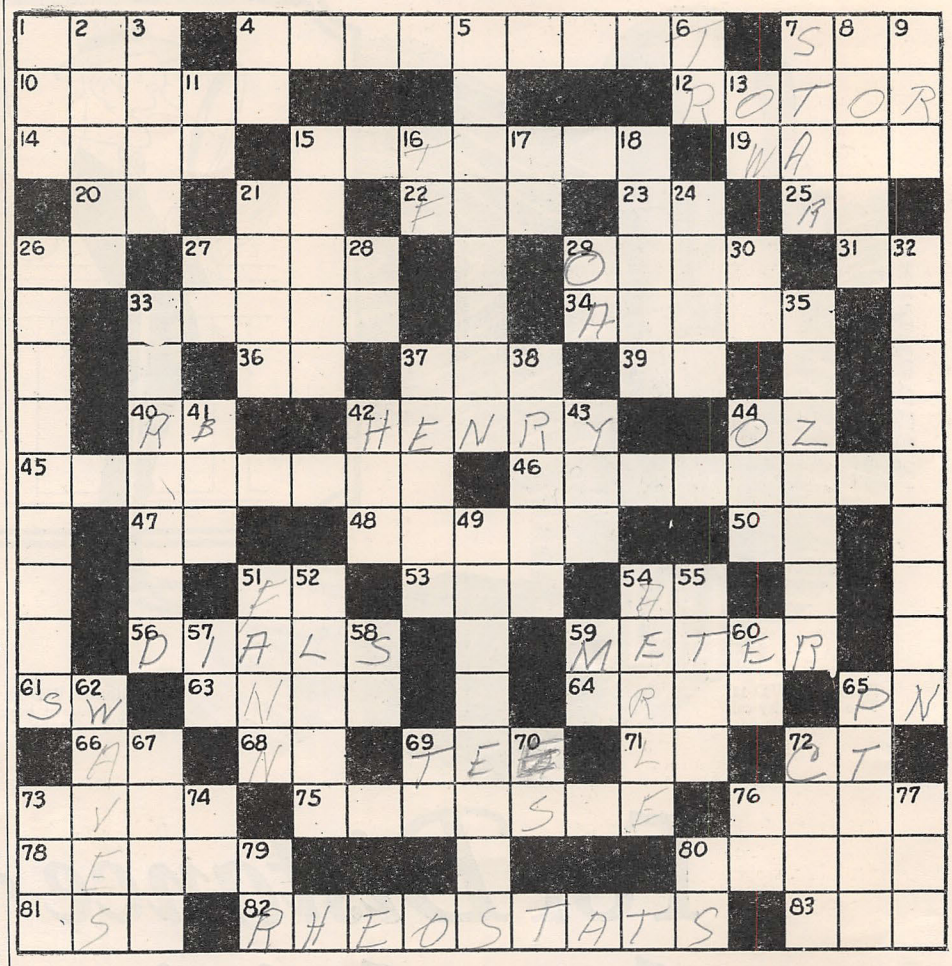
GEN-WIN Short Wave Tuner as used in circuit described in February RADIO NEWS, $7.00.

"——using 3 UV-199 tubes (detector and 2 step)——, I have heard KGO, Oakland, Calif., on the loud speaker twice. At times—KGO could be heard throughout a three-room apartment distinctly."

GENERAL RADIO WINDING Co
214 Fulton St GEN-WIN PRODUCTS New York

RADIO CROSS-WORD PUZZLE

By HUGO GERNSBACK



ANSWER WILL APPEAR IN THE APRIL ISSUE OF RADIO NEWS

HORIZONTAL

1—A prefix meaning upon.
4—Scattered in all directions.
7—A female.
10—A new art.
12—Movable element in radio parts.
14—Dillseed.
15—Used with vacuum tubes.
19—A three-tube radio set.
20—Each (ab.)
21—William, King (ab.)
22—Confined in number.
23—Morning (ab.)
25—A Famous Radio Magazine (ab.)
26—Radio League (ab.)
27—Voltage applied.
29—Radio crystals.
31—French abbreviation for wireless.
33—Father of the telegraph.
34—Positive pole of battery.
36—East Side (ab.)
37—A poisoned morsel.
39—A point of compass (ab.)
40—Radio Bug (ab.)
42—Unit of electrical capacity.
44—Ounce (ab.)
45—Part of electrical apparatus.
46—A new radio circuit.
47—Swedish sand ridges.
48—Force.
50—A printing measure.
51—A state in U. S. (ab.)
53—The God Pluto.
54—A small fresh-water fish.
56—What you tune with.
59—Standard of measurements.
61—A switch (ab.)
63—Unwelcome loud speaker sound.
64—Mineral.
65—Positive and Negative (ab.)
66—Like.
68—+ Terminal (ab.)
69—A beverage.
71—Union League (ab.)
72—Receiver of free tickets (ab.)
73—Stove chamber.
75—A radio outfit.
76—American city.
78—Radio wave measure.
80—Necessary to hear radio.
81—A quadruped.
82—Variable resistances.
83—Georgia (ab.)

VERTICAL

1—Period.
2—A part of radio outfit.
3—Conception.
4—Buyer's option (ab.)
5—Radio receiving instrument.
6—Transformer (ab.)
7—A heavenly body.
8—A loud speaker part.
9—Before.
11—A pronoun.
13—Outer winding (ab.)
15—Metal used in radio.
16—Tuned frequency (ab.)
17—Opposite compass points.
18—Cotton thread.
21—Used for connections.
24—Cry of catwhisker's owner.
26—Telephones.
27—Slang term.
28—Compass point.
29—Outdoor aerial (ab.)
30—A state in U. S. (ab.)
32—A famous radio inventor.
33—A radio manufacturer.
35—A chemical ferment (pl.)
37—Name of a Neutrodyne set.
38—Lower part of radio instruments (pl.)
41—Radio wire.
42—Fool.
43—Locust.
44—A lyric song.
49—Radio.
51—A type of aerial.
52—Radio voltaic element (ab.)
54—Where radio currents enter.
55—Tuning indicator.
57—Naval radio (ab.)
58—Chemical element (ab.)
59—A pronoun.
60—Initials of an American President.
62—Radio vibration.
65—Radio sound receptor.
67—Radio outfits.
69—A radio battery (ab.)
70—Ells Scotch (ab.)
72—Medicinal substance.
73—Medical term suffix.
74—Compass point.
76—Preposition.
77—Done.
79—Railroad (ab.)
80—Steamer (ab.)

EVEREADY HOUR
EVERY TUESDAY AT 9 P. M.
For real radio enjoyment, tune in the "Eveready Group." Broadcast through stations

WEAF	New York	WFI	Philadelphia
WJAR	Providence	WCAE	Pittsburgh
WEEI	Boston	WGR	Buffalo

Dry "B" Batteries are an economical, dependable and convenient source of plate current!

There's more life in Eveready Batteries

BUY Eveready "B" Batteries and you get electricity in its surest, safest and most compact form. They reduce your operating expense. New developments in the Union Carbide and Carbon Research Laboratories, Inc., have been converted into new manufacturing processes in the Eveready factories. Good as they always have been, Eveready "B" Batteries are much better today.

The Eveready achievement of giving you more hours of "B" Battery service for less money has cut the cost of running receivers in half, and in some cases the new Evereadys make "B" Battery expense only a third of what it used to be.

There is an Eveready Radio Battery for every radio use.

Manufactured and guaranteed by
NATIONAL CARBON COMPANY, INC.
Headquarters for Radio Battery Information
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

EVEREADY
Radio Batteries
—they last longer

No. 7111. 1½-volt Dry Cell "A" Battery for all dry cell tubes

No. 772. 45-volt Large Vertical Price $3.75

No. 770. 45-volt Extra Large Vertical for heavy duty Price $4.75

No. 771. 4½-volt "C" Battery improves quality, saves "B" Batteries Price 60c

Hours of Delight

THIS beautiful, compact receiver will do EVERYTHING that can be expected from a much higher-priced set. Add to this the fact it is a LICENSED NEUTRODYNE and you have the reason for its tremendous popularity.

Wonderfully clear tone, volume and power—delivered by FIVE tubes—controlled by only TWO adjustments—and manufactured by a Corporation with 10 YEARS' EXPERIENCE IN THE RADIO INDUSTRY.

Ask your dealer for a demonstration and do not be satisfied with something "just as good" until you see or hear this AMRAD.

Five features of this delightful and technically correct Set are detailed in Folder 520 sent on request. Where may we mail it?

A Genuine Licensed 5-Tube NEUTRODYNE Only $85

AMRAD NEUTRODYNE

"The Voice of the Air"

AMERICAN RADIO AND RESEARCH CORPORATION

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CARTER Portable Jack

75c Takes any Standard Plug

For extending head set or loud speaker. The Screw terminals give a positive contact. The insulation is perfect. Sturdily constructed. Carter quality and workmanship throughout.

Any dealer can supply.

Just the thing to use for extending the Loud Speaker out on the sun porch, etc.

In Canada—Carter Radio Co., Limited—Toronto, Canada.

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Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Correspondence from Readers

(*Continued from page* 1683)

At the same time there is no denying the fact that a good regenerative receiver will pick up signals that are absolutely inaudible on a Neutrodyne receiver and the writer cannot see where Mr. Earnest disproves this by his travels and personal tests from station WEAY.

The efficiency of any set, insofar as its response to *weak* signals is concerned, is emphatically not determined by any type or amount of audio frequency amplification, and a given signal as the detector output of any set will be of the same intensity when amplified by the same audio arrangement. Therefore, Mr. Earnest's tests of two different sets with different audio frequency amplification are absolutely worthless in comparing the actual detector output or the sensitiveness of the sets under test.

Mr. Earnest, in his last paragraph, disputes himself when he begins with making a test "on a very weak signal from WEAY" and winds up by having the signal "fill the whole house." If Mr. Earnest thinks for a moment that a signal which will fill the whole house under two stages of audio amplification is a "very weak signal," then we will have to excuse him and admit he is right, for a signal of this intensity will most assuredly appear better in every respect on a Neutrodyne receiver than on a regenerator, just as he says it did.

Otherwise I will have to ask Mr. Earnest to build for himself a *good* regenerative receiver without audio frequency amplification and a *good* three tube Neutrodyne receiver without regeneration or audio amplification, put a good pair of phones over his ears and convince himself once and for all that the regenerative receiver will pick up understandable signals that the Neutrodyne receiver will not respond to at all. Then if Mr. Earnest will build himself a two-stage audio frequency amplifier and use this *same* amplifier on both sets, he will find that he may obtain fair loud speaker reception from some signals on the regenerative set that are just below audibility on the Neutrodyne.

No, Mr. Earnest, my statement in paragraph five needs no correction, except possibly to more fully emphasize the fact that the loss of regeneration to very weak signals is not easily overcome, especially on wave-lengths below 400 meters, but your statement that a weak signal fills the whole house certainly does need correcting.

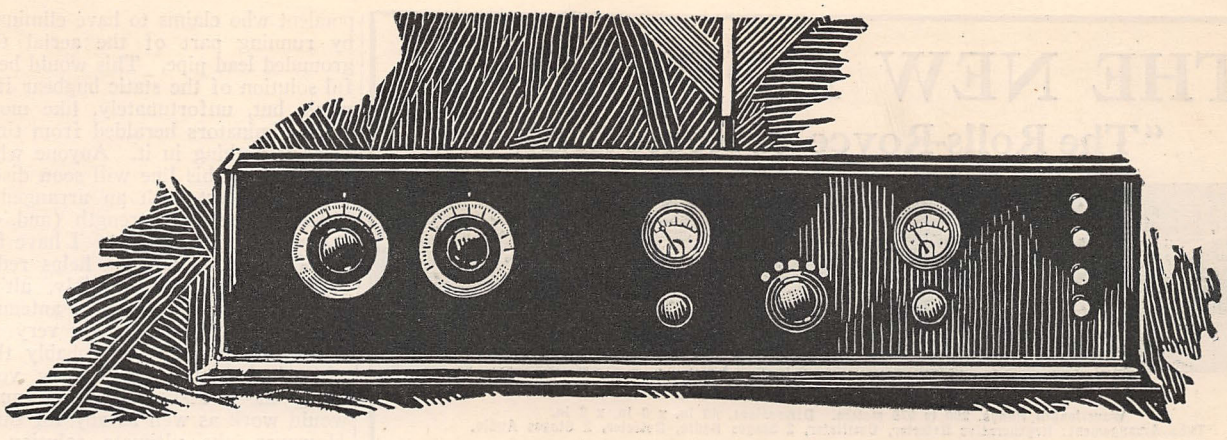
A. L. Groves,
Brooke, Va.

SHORT WAVE RECEIVERS AND STATIC ELIMINATORS

Editor, Radio News:

Your editorial in the November issue on short wave-lengths was timely and good. You say: "It is as yet more or less difficult to build receiving sets operating on such low waves——." Now, the writer, and no doubt thousands of other Radio News readers, would like to know just why this is true. I would also like to see this short-wave matter given more attention in your excellent magazine. In looking over my back numbers I find but one description of a short wave receiver and that was published several months ago and doubtless many improvements have been made since then. Give us more short wave hook-ups and give the fans a chance to get busy and listen in on some of the short wave stuff now being broadcast.

On page 744 of this same November issue you publish a letter from a German corres-



The *Most Lasting* Front for a Radio Set!

FORMICA is the most widely accepted material for radio panels, because it is the best and most uniformly efficient insulator; because it is by far the best looking material; because it is mechanically strong, and because all of its qualities of appearance, strength and insulating ability are as nearly *permanent* as anything made by man can be.

The materials of which Formica is made are chemically inert — they are not in any way affected by weather or time. They will never craze or crack as the best varnish or lacquer ultimately will do. They never deteriorate.

With few exceptions all the leading set makers use Formica because they know it is permanently satisfactory.

Write for booklet, "What Formica Is."

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1 Formica is used by 125 leading set makers. Ninety per cent of the sets in the shows this year had Formica parts.

2 Formica will last forever.

3 Formica in appearance is the finest of all panel materials and always remains so.

4 Formica's electrical qualities of every kind far exceed any possible requirement.

5 Formica has high mechanical strength and will not break in use

6 Formica will not sag from heat or cold flow under pressure. It retains its dimensions. Everything you fasten to it stays tight and precisely where you put it.

7 Formica panels are sold in neat craft paper envelopes that assure you that you are getting the genuine.

8 Formica is one of the most widely used and most generally approved materials in radio.

APPROVED RADIO NEWS LABORATORIES 1925

FORMICA

Made from Anhydrous Bakelite Resins

SHEETS TUBES RODS

Hear the Formica band every Wednesday evening from 9 to 10 Central Standard Time over WLW.

THE NEW MODEL C-7

"The Rolls-Royce of Reception"

MODEL C-7 SUPER-HETERODYNE
Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.
Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio.

Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the *S.S. Western World,* pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEAF, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Brake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective,* and finest reproducing Broadcast Receiver that can be built.

7 Tubes Give the Results of 10

The Reason:— When regeneration is added to a one tube non-regenerative receiver, the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2000 miles is easily obtained on an average small antenna at night under average conditions.

Original Blue Print showing all data, diagrams, circuits, details, etc., $1.00, postpaid.

Experimenters Information Service, Inc.

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Designers of the Highest Class Radio Apparatus in the World

New Book, "Modern Radio Reception," by Charles R. Leutz
325 Pages, 200 Illustrations, Fully Bound, $3.00 Postpaid

To the Radio Dealer

Let us explain how you can make the sale of our publications a worth while, well paying part of your business. Every one that enters your store is a prospective buyer of Radio News. Radio News will sell with little effort on your part.

You may sell our publications on a single copy basis with a fine margin of profit or on a subscription basis with a generous commission allowance.

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Experimenter Publishing Company

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pondent who claims to have eliminated static by running part of the aerial through a grounded lead pipe. This would be a beautiful solution of the static bugbear if it would work, but, unfortunately, like most of the static eliminators heralded from time to time, there is nothing in it. Anyone who experiments along this line will soon discover that the only effect such an arrangement gives is to reduce signal strength (and, of course, static at the same ratio). I have found that an underground antenna helps reduce static of certain kinds perceptibly, alt' gh the energy received from such antenna is very minute and renders tuning very sharp and difficult to maintain. Probably the scheme of reducing the "B" battery voltage and using more audio frequency amplification would work as well as any for this purpose. However, the ultimate solution of static trouble is undoubtedly the short wave. As you have pointed out, the short waves also do not fade and give DX reception in daylight. What more does the fan want?

Respectfully,
D. C. Canfield,
East Canaan, Conn.

(*You will find an excellent article on a short wave receiver in the present issue of* Radio News.—*Editor.*)

FROM ERNESTO DIAZ TO HIS "RADIO FRIENDS"

Editor, Radio News:

It was your courtesy to publish in the October issue of Radio News my inquiry for Radio Friends. I would appreciate very much the publication of the note below; my answer to those who wrote me.

RADIO FRIENDS

Accept my thanks for your courtesy in answering my "Wanted—Radio Friends." To this inquiry I received 217 letters from all over the world—England, Mexico, South America, Virgin Islands, Cuba, Panama and the United States. It is impossible for me alone to handle such an amount of correspondence, so the best I can do is to thank you all heartily for your kindness in writing. Greetings from Porto Rico.

Ernesto Diaz,
Box 224,
Caguas, Porto Rico.

BROADCAST ANNOUNCERS, PLEASE NOTE

Editor, Radio News:

When you are sitting in front of your radio set, late at night, and hear the several powerful stations in New York and New Jersey sign off and leave that precious space of air silent and still, except for occasional static, you are so very much relieved that you let a large, deep and rolling sigh escape.

"At last," you say, "they are gone and now I can try to tune in some real distant stations."

While you are saying this, you slowly turn those all important dials with a rapt and absorbing expression focused on the set. You suddenly stop; you hear some music.

"Ah! There's a station!" you exclaim.

You turn a dial or two so as to bring it in louder. But no, it is impossible to get it any louder. Your expression turns to anger.

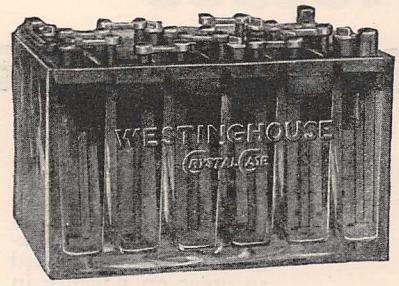
"There's that static!" you say with anger. "If I can't get that cleared away, I won't be able to hear the call letters."

Good! It has stopped. A man's distant but clear voice comes over the air. He starts to tell you what you have just heard.

"The letters! Why doesn't he say the letters?" you demand anxiously.

There he's telling what station it is now.

"This is station ——," he begins and you listen eagerly. But when he comes to the



TYPE 24-RG2
7 5/16" x 5 7/16" x 4¾"
3500 Milliampere Hours

A SUPER B BATTERY

Designed for multi-tube sets, compact in size, large in capacity, this new "B" Battery offers you the following distinctive advantages:

A one-piece crystal glass container affords you at all times a view of the interior.

Easily recharged at slight expense.

No leakage from cell to cell.

Will not pump acid.

Bird cage plates insure long life and steady reliable service.

Large acid space requires less attention.

THE WESTINGHOUSE UNION BATTERY CO.

SWISSVALE, PENNA.

Distributor for Canada:
The Canadian Westinghouse Co., Ltd.
Offices in all principal Canadian Cities

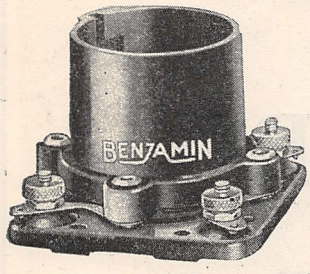
Distributor for South America, Mexico and Cuba:
The Westinghouse Electric International Co.
Mexico City, Buenos Aires and Havana

WESTINGHOUSE
RADIO
"A," "B" and "C"
BATTERIES

Stop Tube Noises Get Clearer Tone

BENJAMIN
CLE-RA-TONE SOCKET
CLEARER RADIO TONE

Shock Absorbing—Spring Suspended



Gives your set a chance to bring through everything that's in it. Tube holding element "floats" on perfectly balanced springs. Keeps out mechanical shock and does away with so-called "tube noises." Spring supports are not affected by stiff bus wiring. Molded parts of genuine Bakelite. A very handsome socket.

Keep your tubes sensitive only to the radio waves. Keep microphonic disturbances, due to jars and vibration out of the receiving set. The Cle-Ra-Tone Socket marked so great an advance in the mechanics of radio reception that it is the choice of the leading manufacturers of high-class sets, and is recommended by the foremost engineers for their most popular hook-ups. Put in Cle-Ra-Tones and look for improvement in reception. You won't be disappointed.

8645 For Standard Base Vacuum Tubes . . $1
8646 For UV-199, etc., Tubes 1

Radio Battery Switch

Lightest and neatest switch made. Mounts in single ¼ inch panel hole. No spacer washers required. Push-pull single contact features give positive contact. When it's in it's off, avoiding accidental cutting in of battery.

No. 8640, $0.30

Radio Bracket

Gets the wiring out of sight. Adaptable for standard cabinet mounting. See illustration below. No. 8629, per pair, $0.70.

Grid Leak Panel

With the bracket, provides a safe, secure mounting for this important element. No. 8632, each, $0.15.

Cle-Ra-Tone Gang Socket and Mounting Shelf

Simplifies construction of the larger receiving sets, and may be used with most of the latest hook-ups. Consists of Cle-Ra-Tone Shock-Absorbing Sockets attached to Bakelite mounting shelf with set of binding posts and markers. There is adequate space for mounting of accessory equipment.

Standard VT Sockets	or	UV-199, etc. Sockets	Dimensions of Shelf	No. of Sockets	
8613		8603	7⅞″ x 4⅛″ x ¼″	3	$5.50
8615		8605	17¼″ x 4⅛″ x ¼″	5	10.50
8626		8606	17¼″ x 4⅛″ x ¼″	6	11.25
8627		8607	17¼″ x 4⅛″ x ¼″	7	12.00

Prices do not include Bracket or Grid Leak Panel

Brackets and Grid Leak Panel extra, as shown above.

Ask for Benjamin Radio Products at your dealer's or write us.

Benjamin Electric Mfg. Co.
120-128 S. Sangamon St., Chicago
247 West 17th Street, New York — 448 Bryant Street, San Francisco

Overstock Bargains in

NEUTRODYNES
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You can now quickly learn to make comics, sport cartoons, animated and serious cartoons, etc. Cartooning is lots of fun—and fun that pays **big money**! Learn cartooning at home in spare time this amazing easy way.

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Mail postcard or letter today for Free Book on Cartooning. It tells all about this easy method perfected by one of America's most successful cartoonists—also is filled with interesting facts about cartooning. Mail card TODAY! **Give Age if under 16 years.**

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Room 1043C, 1113-15th St. N.W., Washington, D.C.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

letters he says them so fast that all you get is "W——" something or other. And then the static begins again. It's useless to resume listening.

"Blankety - blank - blank - blank announcer. S'fine way to announce a station! Spills them out so fast you can't understand one letter! And after all my patient waiting for those other stations to get off the air! Believe me, I'd like to give him some announcing lessons."

A long pause and a very deep sigh. This time not one of relief but of regret.

"Well, it's after one. Guess I'll go to bed."

Announcers, one and all, hear my earnest plea. Why make life so hard for us poor "listeners-in?" Aren't you proud when your station is heard some 200 or 700 miles away? Won't you call your letters out so we may at least find out who you are?

L. VON BUCKOW,
Maplewood, N. J.

INTERFERENCE DURING INTERNATIONAL BROADCAST TESTS

Editor, RADIO NEWS:

The International broadcast test, November 24 to 30, was one of the most interesting radio tests ever made in America, from both the user's and dealer's viewpoint. I think this test was badly hampered because of lack of good judgment on the part of some stations such as WOAI, San Antonio, Tex.; KHJ, Times Mirror Co., of Los Angeles, one of the Hollywood stations and a Mexican station.

It is bad enough for stations to transmit during the silent period, but when stations resort to giving Scotch programs during the silent period, giving the impression to the "listener in" that they have actually heard Scotland, and later find out that it was not Scotland, but an American station, leaves a bad taste in the amateur's mouth.

As the writer understands it, these tests are to be undertaken from time to time, and the radio press at large can do more towards keeping up this interest than any other instrument known. These stations should be taken in hand and should be shown the way to play fair with all concerned. The stations in Chicago, New York and other large cities are more important than the "interferers" and they were kind enough to respect the tests.

Why cannot influence be brought to bear on this matter in the future?

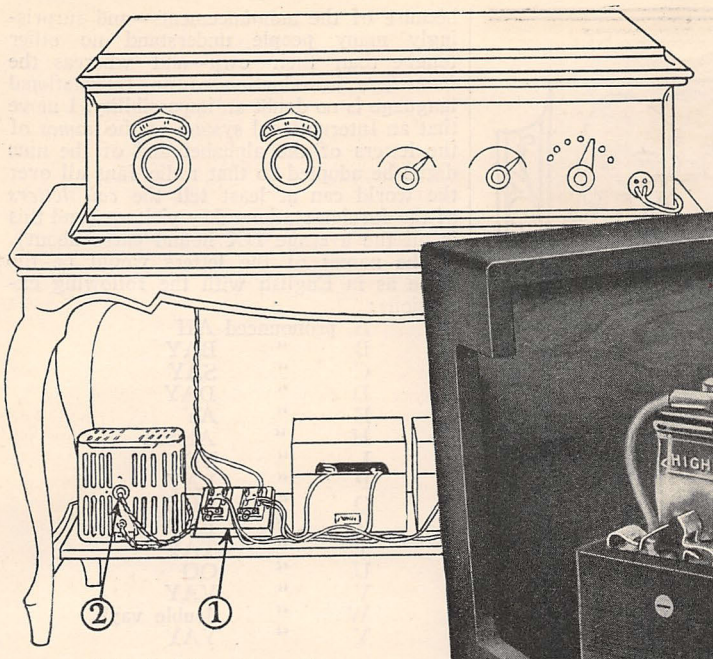
Monday night is silent night here and all stations are silent. However, there are two stations, while not exactly in Chicago they belong to the Chicago territory. The Elgin station, for instance, carries a wire from one of Chicago's leading hotels to Elgin and broadcasts from there. The Zion City station gives its customary Monday night program. Both of these stations are so strong and interfere so much along the North Shore that it is next to impossible for an amateur with an ordinary set to get anything else on Monday night except these two stations. Naturally, this kills the sales for smaller sets.

O. H. HENKEL,
Peerless Light Company,
Chicago, Ill.

AN INTERNATIONAL ALPHABET

Editor, RADIO NEWS:

I have a suggestion to make in a very few words, about which I am in the greatest sincerity. Due to the fact that International reception has become a common occurrence, and because thousands of the people in France, Germany, England, Spain and Italy, as well as in North and South America, who listen daily to broadcasting in foreign tongues are unable to tell what stations they hear



Philco "B" Batteries on Charge

To connect the batteries to your set, throw over switches on Charging Panel (1) and pull out plug (2) from the built-in receptacle on the Philco Charger. Simple as A B C.

Philco Single Charger for all "B" batteries and UD44 "A" batteries. Noiseless. Price—$9.75

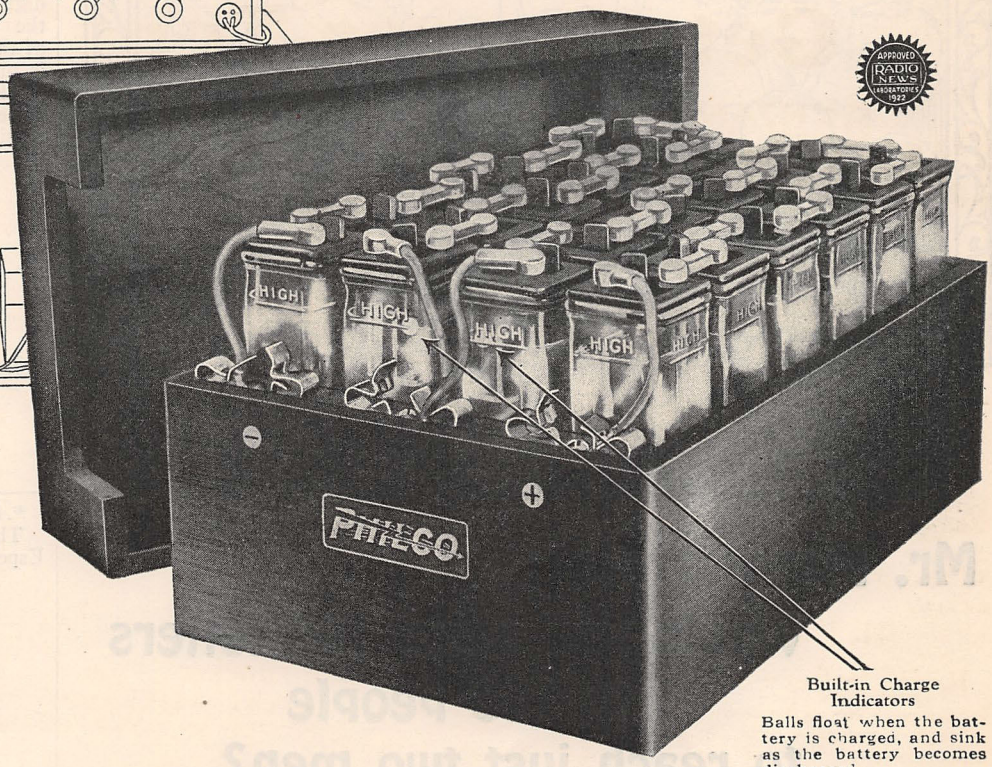
Philco Double Charger for all "B" batteries and UD86 "A" batteries. Noiseless. Price—$15.00

Charger prices include plugs and receptacles.

Philco Type DX "B" Battery with de luxe mahogany-finish case with cover (48 volts). Price—$20.00

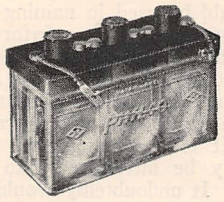
Type DXO, without cover—$16.50

"B" Charging Panel, factory wired and ready for use —$2.75



Built-in Charge Indicators

Balls float when the battery is charged, and sink as the battery becomes discharged.



Philco Pressed-Glass Case "A" Batteries

Spray-proof. Stay dry and clean always. Built-in Charge Indicators.

Type UD86 for storage battery tubes—$16.00

Type UD44, "a dry cell replacement" enabling you to get better results out of dry cell tubes. Occupies less space than three dry cells and may be installed permanently in the radio cabinet. Price—$8.00

Philco Mahoganized-Case "A" Batteries

Types RAR and RW for storage battery tubes. In beautiful Adam-brown mahogany-finish cases harmonizing with your radio cabinet. Price—$14.50 up.

Philco Charge Tester—permanently mounted in filler cap—avoids fussing with a hydrometer —$1.00 extra.

Recharge in your living room

without changing a wire!

YOU need storage "B" batteries because clear and distant radio reception depends on steady, non-drooping voltage and strong, hum-free current. Philco has made "B" storage batteries easy, convenient and economical to operate.

To Recharge—just throw the Charging Panel switches and insert the plug in the Philco NOISELESS Charger. Cost —five to ten cents. You don't move the batteries nor disconnect a wire. You avoid all danger of getting positive and negative mixed and burning out tubes.

Clean, Dry and Beautiful. The tightly sealed glass cells are assembled in Adam-brown mahogany-finish cases harmonizing with radio cabinets and furniture.

Built-in Charge Indicator. Tells you at a glance how much charge is in the battery at any time. Does away with the old-fashioned hydrometer.

Philco makes storage "A" batteries of similar convenience and economy. Also high-powered starting batteries for your automobile. Your Philco is sure to be new and fresh because, of course, Philco Batteries are shipped Drynamic (dry-charged).

See your nearest Philco Service Station, Radio or Music Dealer.

Philadelphia Storage Battery Company, *Philadelphia*

PHILCO DRYNAMIC RADIO BATTERIES

REG. U.S. PAT. OFF.

JOBBERS *and* DEALERS—Philco has brought radio batteries out of the cellar and put them in the living room. Our new Radio Manual tells how. Fill out coupon below and we will mail you a copy.

Name .....

Street ..... *City* .....

State ..... *Jobber* ☐ *Dealer* ☐

Mr. Manufacturer:

Would you write 100 letters to 100 people to reach just two men?

Then, before you invest your advertising dollars—THINK!

An analysis shows that publications of general circulation, newspapers and magazines, devote less than 2% of their reading columns to radio—proving that, in the opinion of their own editors, less than 2% of their readers are interested in radio. In fact, many general publications carry no radio editorial matter. Therefore—98% of your investment is lost! On the contrary, the radio magazine offers 100% radio editorial—attracts 100% potential buyers.

Spend your advertising appropriation in Radio Magazines. Be sure of the greatest possible return on your advertising dollar.

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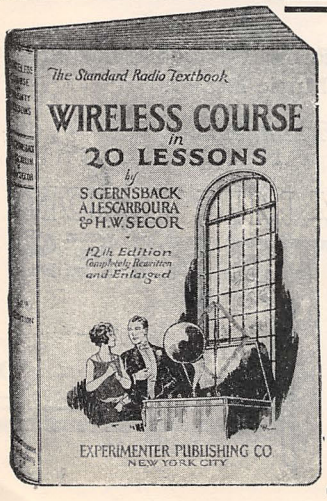

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The Finest, Most Complete Textbook On the Market

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because of the announcements—and surprisingly many people understand no other tongue than their own—and whereas the *immediate* introduction of an International language is no doubt an impossibility, I move that an International system of the *names* of the letters of the alphabet and of the nine digits be adopted so that radio fans all over the world can at least tell the *call letters* of the foreign stations they pick up (and this is all the average DX hound cares about).

The names of the letters would be the same as in English with the following exceptions:

A	pronounced	AH
B	"	BAY
C	"	SAY
D	"	DAY
E	"	AY
H	"	AHSH
I	"	EE
P	"	PAY
Q	"	KOO
R	"	ERR
T	"	TAY
U	"	OO
V	"	VAY
W	"	double vay*
Y	"	YAY

**As in English or French.*

The names of the digits would be as in Esperanto.

1—UNU	pronounced	OO-noo
2—DU	"	DUE
3—TRI	"	TREE
4—KVAR	"	KVAHR
5—KVIN	"	KVEEN
6—SES	"	SAYS*
7—SEP	"	SAYP*
8—OK	"	OAK
9—NAU	"	NOW

*AY *as in MAY.*

This system would be used in naming the call letters or in spelling out any information such as the address of the station, etc. The call letters could of course be given first in the language of the announcement and would then be repeated in the International alphabet. It is my belief that this system could easily be introduced into all broadcast stations. It undoubtedly would be a great booster for International broadcasting—the first real step toward an International radio language. Accept my sincere wish toward the success of Esperanto, the only real International language, and toward the continuous prosperity of your excellent magazine.

DONALD W. HATHAWAY,
755 Buena Ave., Chicago, Ill.

EVENTUALLY, WHY NOT NOW?

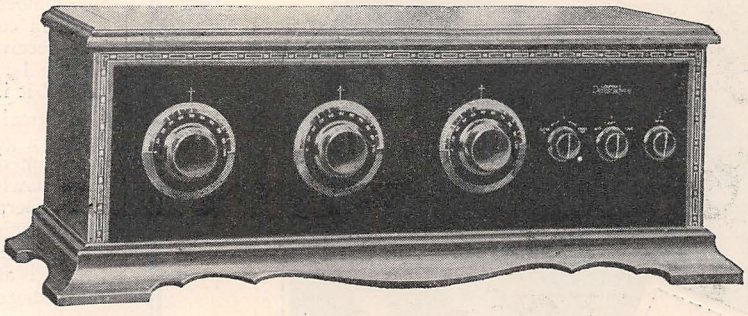
Editor, RADIO NEWS:

After struggling through six nights of interference during the trans-Atlantic broadcasting tests, I cannot refrain from expressing my opinion as to the absurdity of permitting the use of regenerative receivers.

The trans-Atlantic tests were practically a failure. Why? Because every "blooper" in the country was doing its stuff, and judging by the way it sounded, they must all have had 90 or 100 volts on the plates of their detector tubes. Lest I am misunderstood, I want to say that by "blooper" I do not mean all regenerative receivers, for I do not believe that there is anything better than a good three circuit regenerative receiver when properly handled.

The Radio Inspector's office is flooded with complaints against the amateurs, when 90 per cent. of the interference is caused by the broadcast listeners themselves, using single circuit and close coupled regenerative receivers.

There is absolutely no excuse for having one of these radiating receivers when it is so easy to modify the now obsolete single



Features of Deresnadyne Performance—

the Paddlewheel Inductance

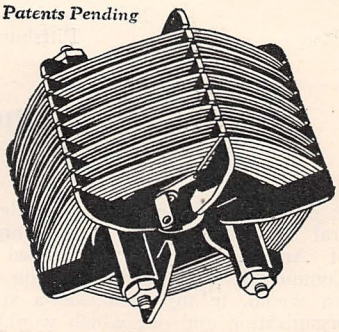
Deresnadyne performance in the hands of its users during the past season has been a revelation. The Deresnadyne is selective. In the largest cities, no matter how many local stations are going, the Deresnadyne tunes them all out to bring in outside stations with amazing clarity and strength. During International week Deresnadyne Owners did not merely "get" Europe. They heard full programs, including the call letters of European stations, clearly and distinctly over the loud speaker.

The reasons for Deresnadyne performance lie in the basic merit of the Deresnadyne principle, which marks a new stage in radio development, and in the design and quality of the apparatus. For example, there's the exclusive Paddlewheel Inductance.

Buy a Deresnadyne at your dealer's today. If he cannot supply you, write to us. *New De Luxe model, $165, without accessories.*

DEALERS: *Order through your jobber*
JOBBERS: *Write for our proposition*

Patents Pending



The Andrews Paddlewheel Inductance

The *Andrews Paddlewheel Inductance* is a radically new type of coil. It has a remarkably high ratio of inductance to resistance—the measure of coil efficiency. The small amount and placing of the insulating material by the unique paddlewheel construction has reduced absorption losses to a minimum. The compact spiral winding makes possible the use of large wire, without increasing distributed capacity, thus lowering resistance. The wire is held in place by slots, and each group of turns is space insulated from the rest, eliminating inefficient lacquer and insuring a moist-proof coil. The *Andrews Paddlewheel Inductance* effects a marked increase in both signal strength and selectivity.

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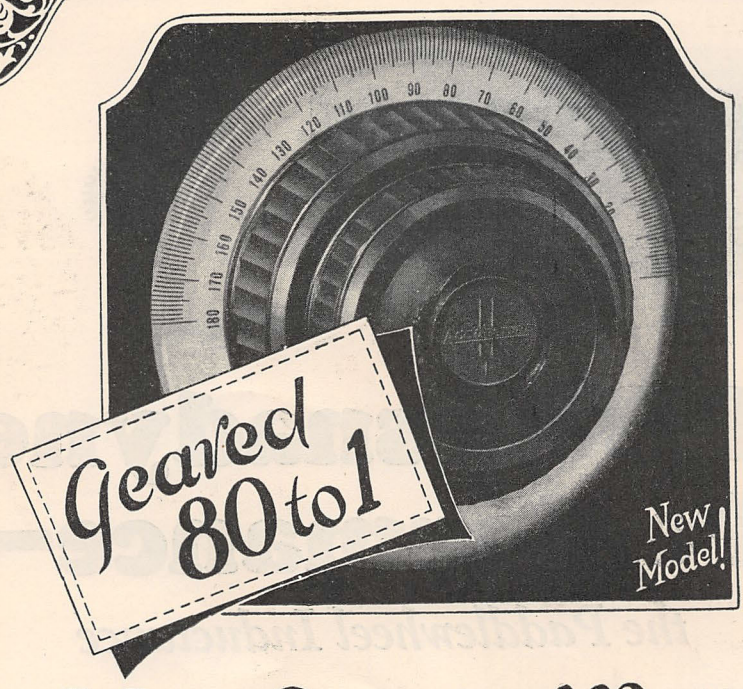

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An ideal operating ratio—not too low nor too high—for infinitely close tuning with perfect ease. A ratio approved by leading radio engineers and proven by the silent endorsement of thousands of users.

New Accuratune Micrometer Controls mark an unusual advance in tuning devices! Designed upon a new principle which eliminates all lost motion and back lash. Increasing tuning efficiency over that of any known vernier or tuning device. A truly wonderful instrument—indispensable in DX work.

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No Back Lash.
No cutting of Condenser shafts.
No wobble of dial.

Accuratune Micrometer Controls fit all standard condenser shafts. Mount flush with panel. Easily replace ordinary dials with no set alterations.

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ACCURATUNE
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MICROMETER CONTROLS

Young Men—Turn Your Spare Hours Into Money!

Earn big profits, prizes, and awards selling RADIO NEWS, SCIENCE & INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST in your neighborhood. We train you as our salesman and pay you liberally for your time. Write at once and we will help you to get started. M. BRIDWELL

THE EXPERIMENTER PUBLISHING CO., 53 Park Place, New York, N.Y.

circuit by the addition of a primary coil loosely coupled to the secondary. There has been very little written in the radio magazines along these lines, and it is surprising the number of pictorials that still print hook-ups and construction data on the single circuit receiver, notwithstanding the fact that all the large radio manufacturers have discarded it in favor of the later developments.

It certainly is not a pleasure, when listening to a good broadcast program, to have it interrupted by the squeaks and squeals of these howlers. One would not want to listen to an opera if several husky dogs were exercising their lungs in the orchestra pit at the same time. I hardly think the opera would be well attended. It is hard to say how many more radio fans we would have if they didn't have to listen to the squeals now filling the air.

It will only be a question of time until the radiating receiver will be ruled out by the broadcast listeners themselves, so why not help the cause along by advising the misguided how to improve their reception?

The radiating receiver must go eventually. Why not now?

H. L. Pearson,
Operator, WCAE,
1028 Morrison Ave.,
Pittsburgh, Pa.

This Union Business

(*Continued from page* 1687)

as our radio services are controlled by several separate interests, but an organization of American operators affiliated with the Commercial Telegraphers' Union of America would, to my mind, be a very strong organization and one which would offer the American operator a very fair protection. Affiliation with the older union is most desirable, taking in as it does the vast army of commercial telegraphers (Morse) throughout America, which union has "been through the mill" and is well organized and handled. This is a very desirable asset to a new organization, and in the formation of an American Radio Telegraphers' Union, the commercial union men should be consulted as a very first step.

I will not attempt to set down the Canadian agreement with the C. T. U., but will sketch its essentials in order that the American operator may see in just what way the two organizations work together and thus gain a definite, fair working arrangement for both operators and employing companies.

The first point taken up in the agreement is the "seniority" question. This is, perhaps, one of the most important single questions today, and in the United States seniority at the present time receives practically no recognition. True, the older men in the service are more apt to receive assignments than green hands, but merely because they can deliver better service for the same wages. Not so, across the border. The agreement states, "The right of seniority shall govern in all cases, ability, technical and otherwise, being equal." It goes on to define seniority so that there may be no possible misunderstanding: "Seniority shall be determined by accumulated service, and seniors under this clause who have the requisite ability, technical and otherwise, shall be eligible for, and shall receive consideration in the matter of appointments to the higher positions in the service." Very fair, is it not, to both sides? Along the same lines: "Any telegrapher in good standing whose services have been dispensed with on account of reduction in staff, shall be given preference in the filling of new positions or vacancies, ability, etc., being equal." Further, "In case of reduction of staff, the junior telegrapher shall be dispensed with first, hav-

One Master Control with three stages of Thermionic Frequency

Price $140
Without Accessories

OUTBOAST your fan-friends with a Thermiodyne! Three stages of Thermionic Frequency *before* Detector and two stages of Audio Frequency, all under a single master control calibrated in wavelengths—*there's* something to talk about! The turn of one knob and the station comes in at the setting listed in the radio program. Power! Tremendous range in selectivity! Six tubes that bring in distant stations with loud speaker volume! And so easy to operate that "kid sister" in the third grade can tune in six to ten stations per minute!

Four refiners, independent of the master control, stabilize variations in broadcasting and regulate volume. Powerful local stations can be cut out and distant stations brought in and held without interference. No fishing or straining or howling or distortion. If it's in the air Thermiodyne brings it in clearly and always at the same setting.

And remember this—any accessories may be used with Thermiodyne; our guarantee is unconditional.

If you've never listened in with a Thermiodyne you've never really heard radio! Let your dealer give you a demonstration today—write *us* for free booklet.

DEALERS AND JOBBERS

Write for full particulars regarding franchise for selling the most remarkable receiving set on the market. A few territories are still available, but act quickly.

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"The Perfect Broadcast Receiver"

A New Superior Broadcast Receiver

Simple—Long Range—Highest Quality
Non Radiating — Non Regenerative

Two Stages Tuned Radio Frequency-Detector and Three Stages of Audio Frequency Amplification

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Completely Constructed

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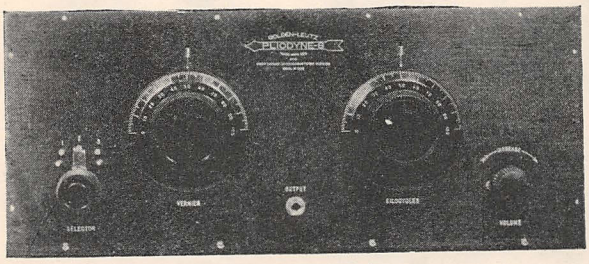

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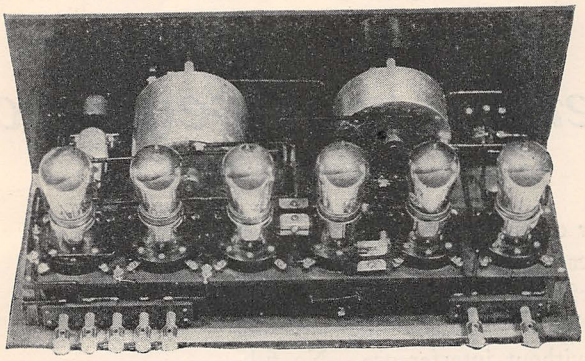
Front View Showing Simplicity of Control



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We guarantee every Golden-Leutz "Pliodyne 6" to be the finest broadcast receiver that can be manufactured using 6 tubes or less and to be satisfactory to you in every way and to reach you in perfect condition.

You take no risk whatever in sending us your order for unless you are completely satisfied with the receiver and with your saving you may return the receiver to us and we will refund your money.

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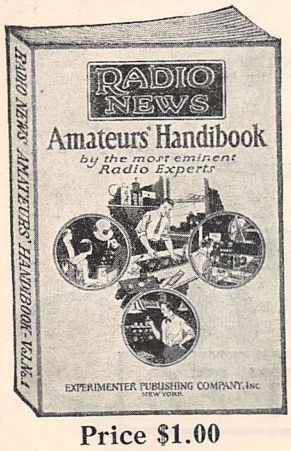

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Chock full of radio constructive and instructive articles from cover to cover. Written by foremost radio authorities, in plain everyday language which everyone can understand. Sections include articles on Receiving Sets and Sundry Apparatus, Transmitters and Accessories, Radio Theory, Vacuum Tube Data, and Practical Hints for the Amateur. A book which also serves as a ready reference and should find a place in the library of every amateur. It contains 224 pages and over 375 illustrations, diagrams, and photographs, bound in a multi-colored heavy board. On sale at all leading radio stores. If your dealer cannot supply you, send a dollar bill and the book will be forwarded to you postpaid.

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53 Park Place, New York

ing due regard to the exigencies of the service, ability, etc., being equal."

ABOUT WAGES

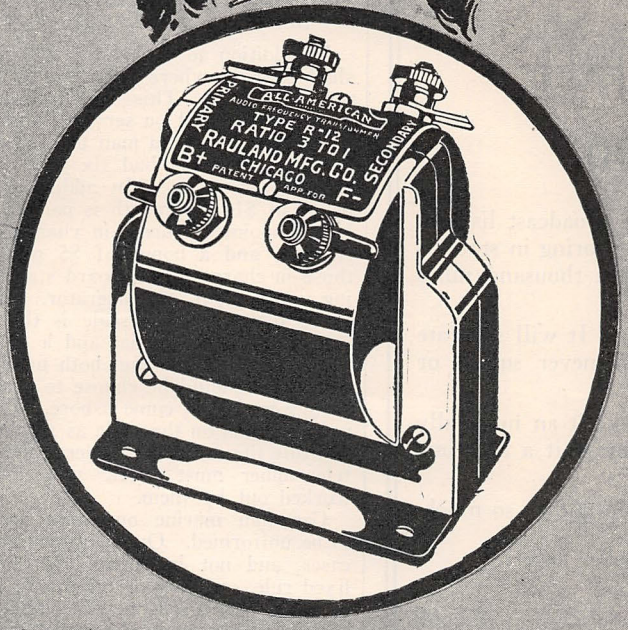
In a haphazard manner, and generally when convenient, these customs have been recognized on our side of the line, but the practice has not been binding. Such arrangements are very fair, and should be definitely written in the proposed American action. Our Canadian agreement then goes on to discuss leave of absence—another much mooted question in the United States. They care for it in this manner: "Coast station telegraphers on completion of one year's service shall be granted two weeks' leave of absence at the company's convenience each year *with full wages per scale and maintenance allowance.* (This probably means a contest in the States, but it seems only fair that faithful service should receive such a reward.) Vacation periods shall *not* be cumulative (protecting the employer) and payment in lieu of lapsed vacations shall not be made. Generous effort shall be made to grant vacations of uncertain and variable duration, and with full wages as per scale, to ships' telegraphers who have been on extended voyages immediately prior to their return, and who have been unable to secure any vacation for a long period."

Hours of service per day which a telegrapher should be required to serve have also been the cause of much debate among interests in the States. There is no fixed rule, and the hours are generally arranged to suit the convenience of the company and to try and accommodate the individual. I know personally of a number of ships and stations where a 12-hour tour of duty, seven days a week, is required of the operators. Whether or not an overtime allowance should be made is a matter for discussion and is handled in Canada in this way: "In the event of a three-man station being short-staffed, thereby making it necessary for the remaining two telegraphers to keep a constant watch between them, *overtime for the extra duty in excess of eight hours per day shall be paid at the rate of time and one-half of the regular daily wage,* computed on the basis of 365 working days per year, exclusive of allowances." How our own employing companies will react to such an arrangement is also a question, but it is the common custom in almost every trade and profession in the United States, so why not for radio telegraphers?

No agreement would be complete, of course, without some provision made for arbitration, and so we have: "The company shall, upon request of the General Chairman, meet a committee to deal with matters in dispute such as wages, working conditions, grievances, etc., whether the foregoing be alleged or actual." The usual form, and generally acceptable to both.

It is a well-known fact that the U. S. radio operator does not, as a class, take his position seriously enough, and consequently when it comes to leaving a vessel of his own accord, he generally does so on a few days' or often a few hours' notice. This often inconveniences the company, but the operator will come back with a statement that he doesn't get more notice than that when he is to be relieved or placed "on the beach." This is cared for in Canada in this fashion: "Telegraphers leaving the service of their own accord shall be required to give the company 15 days' previous notice in writing, and acknowledgment of the receipt of such notice shall be sent without delay by the proper authority and such acknowledgment shall advise acceptance or rejection. The company shall be required, in the event of reduction in staff, to give 15 days' notice in writing or 15 days' wages in lieu thereof." Dismissal cases where misdemeanor has been

What *Reliable Radio* Means to You



¶ An assurance that, when you try out a hook-up, you can rely on your instruments to give you a *fair test*. ¶ A knowledge that each part has been put to such searching tests that its proper performance, *under any conditions*, is assured. ¶ In short, a conviction that each individual part *will continue* to do its work *year after year*.

Two pleasant hours spent with the RADIO KEY BOOK will acquaint you with the essential facts of modern reception, and how to enjoy it at its best. Ten cents—coin or stamps—brings the KEY BOOK.

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A laboratory grade audio transformer for music lovers. R-500.....$9.00

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Complete receiving sets with extraordinary range, volume and selectivity. All parts mounted on panel and baseboard, with full instructions for wiring. All-Amax Junior (one-tube).....$22.00
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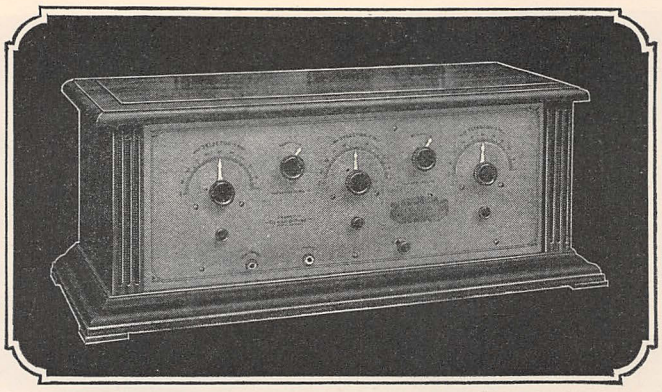

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SUPER CLEAR-O-DYNE

FIVE TUBES, $120.00

THIS tuned radio frequency set will give the average broadcast listener greater satisfaction than any other he can buy. It will bring in stations from coast to coast in good radio weather. Stations a thousand miles away come like local on the loud speaker.

It will tune out several local stations and bring in distance. It will separate distant stations no more than five meters apart. It will never squeal or re-radiate. A child can get distance.

Solid mahogany cabinets and gold finished front panels make it an unusually beautiful piece of furniture. The best possible materials make it a life time investment.

It is much more moderately priced than many sets which do not do so much.

Clear-O-Dyne is going big. Quick deliveries on dealer orders.

Five Tube Console $190.00
Four Tube Console $135.00

Clear-O-Dyne Model 70 .....$75.00
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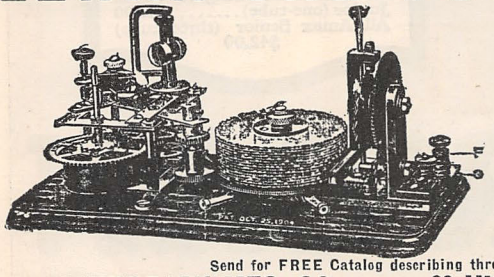

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THE **OMNIGRAPH** is not an experiment. For more than 15 years, it has been sold all over the world with a money back guarantee. The **OMNIGRAPH** is used by several Depts. of the U.S. Govt.—in fact, the Dept. of Commerce uses the **OMNIGRAPH** to test all applicants applying for a Radio license. The **OMNIGRAPH** has been successfully adopted by the leading Universities, Colleges and Radio Schools.

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If you own a Radio Phone set and don't know the code—you are missing most of the fun

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

proven are, of course, not entitled to these benefits. Further, in the event a telegrapher is dismissed on charges which are later found false, he is entitled to reinstatement and reimbursement for lost wages.

THE SCALE

Of perhaps greatest interest to our own commercial operators is the wage scale, effective in Canada under the terms of the existing agreement. Salaries are based entirely upon length of service, which is perhaps the simplest and most satisfactory system, although we have such a variety of duties in connection with our own radio services that additional provisions would probably be advisable in the United States to care for special work, such as Chief Operator of a particularly heavy traffic ship or station such as our *Leviathan* and similar posts of duty. However, in actual money, the following holds in Canada:

First	year.....	$70	per month
Second	"	75	" "
Third	"	85	" "
Fourth	"	95	" "
Fifth	"	105	" "
Sixth	"	115	" "

In addition to the above, $38 per month shall be paid where maintenance (food) is not furnished. This in effect makes the wage scale, based on service, from $108 per month for the green man to $153 per month for a man having had six years of service with the company. In addition to this, a bonus of $15 per month is paid to all regularly appointed officers in charge of coastal stations, and a bonus of $5 per month to those in charge of shipboard stations, carrying more than one operator. It will be noted that the wage scale is the same for service ashore or afloat and a man can attain as high a standing, both financially and otherwise, should he choose to remain afloat than were he to come ashore. I will offer no comments on the scale as set down. One befitting the conditions under which the U. S. telegrapher must work will have to be worked out by them.

Canadian marine operators are required to be uniformed. Our own men are in some cases, and not in others. It should be a fixed rule, one way or the other; preferably in favor of a uniform. Canadian operators receive an annual uniform allowance of $45 for the plain clothing, and all uniform trimmings—buttons, braid and insignia are furnished by the company.

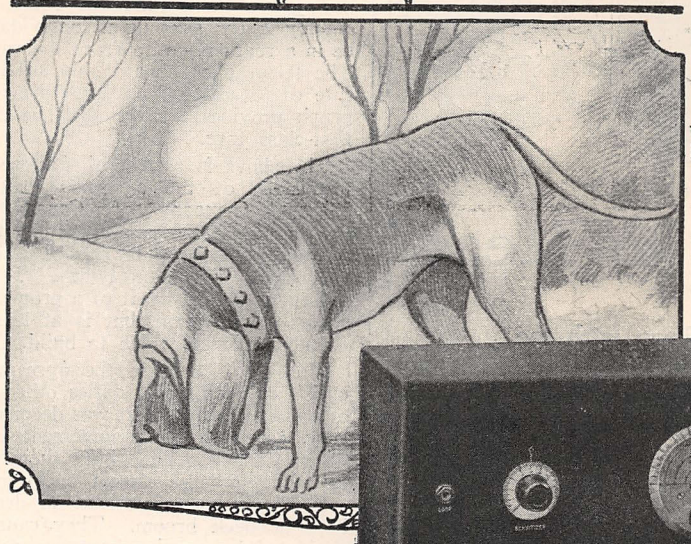
A few additional provisions for the shore station telegraphers are provided, as follows: "Fuel shall be supplied by the company, but not for dwellings." "Light for all dwellings and station buildings shall be supplied by the company." The company also agrees to rent the dwellings to the station personnel at a rental not to exceed $9 monthly.

To return to wages again: They are computed from and shall include the date upon which the telegrapher actually receives his orders to proceed to some ship or station for duty; not as in our country, commencing when actually on hand ready to begin duty. Further, a telegrapher, upon being laid off, receives his wages and maintenance from the point of such layoff to his divisional headquarters, being paid in full for the time enroute.

OTHER PROVISIONS

In the event of transfer, sufficient funds shall be *advanced* to cover reasonable expenses incurred, and telegraphers traveling upon the company's business shall be entitled to first-class rail and steamship transportation and fare, hotel accommodation and board.

The status of a marine operator is also very definitely set forth, and should be of particular interest in view of the existing discussion of an operator's position aboard



The bloodhound, remarkable for the acuteness of its smell, can pick up a scent and follow a trail when all else fails.

Sensitivity

-never before thought possible!

With the extreme acuteness of the bloodhound's scent, the Model L-2 Ultradyne detects the faintest broadcast signals—signals that are "dead" to other receivers—regenerates and makes them audible on the loud speaker.

It's here, where the development of other super-radio receivers has halted; the Ultradyne forges ahead.

The unusual sensitivity of the Model L-2 Ultradyne is due to the successful application of regeneration, to the famous Modulation System of radio reception, recently perfected by R. E. Lacault, E.E., A.M.I.R.E., Chief Engineer of this Company and formerly Radio Research Engineer with the French Signal Corps Research Laboratories.

It's this development, an exclusive feature of the Model L-2 Ultradyne, that makes it possible to receive greater distance on the loud speaker.

In addition the Ultradyne is the most selective receiver known. Regardless of close similarity in wavelength, it selects any station within range —brings in broadcasting clearly, distinctly, faithfully.

Everything that the Model L-2 Ultradyne means in actual results and genuine satisfaction, you will appreciate the first evening you operate it.

THE ULTRADYNE KIT

Consists of 1 Low Loss Tuning Coil, 1 Special Low Loss Coupler, 1 Type "A" Ultraformer, 3 Type "B" Ultraformers, 4 Matched Fixed Condensers.

To protect the public, Mr. Lacault's personal monogram seal (R. E. L.) is placed on all genuine Ultraformers. All Ultraformers are guaranteed so long as this seal remains unbroken. **$30.00**

How to Build and Operate the ULTRADYNE

32 page illustrated book giving the latest authentic information on drilling, wiring, assembling and tuning the Model L-2 Ultradyne Receiver..... **50c**

Write for free descriptive folder.

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MODEL L-2

PHENIX RADIO CORPORATION

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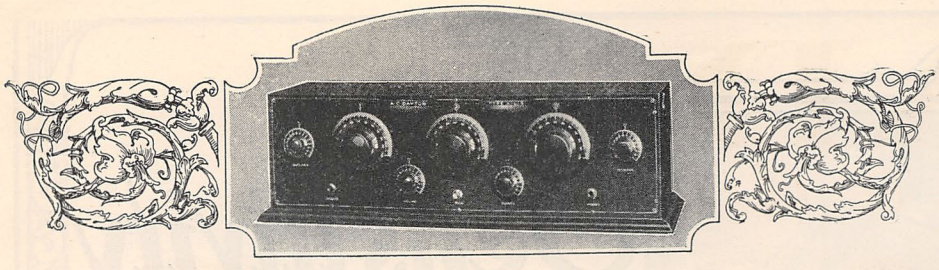

What Do You Want to Hear?

THAT'S the usual question, if you sit down with the man who owns an A-C DAYTON XL-5. And whatever station you ask for, he will get quickly, clearly and without distortion, for the XL-5 is the very acme of radio reception.

Here's a combination for you—Unfailing Selectivity—Remarkable Clarity of Tone—Distance and Volume to spare. A five-tube wonder-receiver (tuned radio frequency) all built into a handsome mahogany cabinet.

The price?—A sensible one—$115.00 less accessories ($120.00 Denver and West).

Find the A-C DAYTON Dealer today and ask him to demonstrate the XL-5. Or write direct to us and we'll send you his address, with full information.

PROVEN BY PERFORMANCE

THE A-C ELECTRICAL MFG. COMPANY
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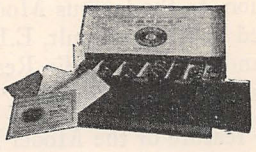
Makers of Electrical Devices for over Twenty Years

XL-5 KNOCKED DOWN

For those who prefer to build their own receiver, the A-C DAYTON XL-5 is furnished in knock-down form.



The cost o this set in knock-down form, complete with all parts and directions, is $72.50 ($76.50 Denver and West).

A-C DAYTON XL-5

Young Men—Turn Your Spare Hours Into Money

Earn big profits, prizes, and awards selling RADIO NEWS, SCIENCE&INVENTION, The EXPERIMENTER, and MOTOR CAMPER & TOURIST in your neighborhood. We train you as our salesmen and pay you liberally for your time. Write at once and we will help you get started. M. BRIDWELL

THE EXPERIMENTER PUBLISHING CO.
53 Park Place New York, N. Y.

ships of United States registry. Canada says: "Ship owners shall furnish radio officers with medical and other attendance and comfortable sleeping accommodation, and where more than one radio officer is employed, the sleeping accommodation shall be in a room separate from the radio cabin. The telegrapher aboard ship shall hold the title of "Radio Officer." A previous paragraph provides that he shall be entitled to first-class fare.

The above is a general statement of the provisions of the agreement between the Marconi Company of Canada and the C. T. U. of America. There are many little minor provisions, but I have attempted to cover only the main points. It may not present a perfect draft of a proposed United States organization, but is at least a good foundation upon which to build.

Nothing is said in the agreement about operators performing duties other than that of radio telegraphy. It was deemed unnecessary, for such an arrangement is unheard of in Canada. They hold their profession in much too high esteem to so forget their self respect as to turn to on deck with a hose or deck broom. They cannot be intimidated by roaring captains, as, unfortunately, so many of our American boys have been. Combining telegraphy with the duties of a purser, or other ship's officer, is not objectionable, but deck work and other menial labor would ostracize a Canadian telegrapher from the fraternity.

SOS—Its Real Import

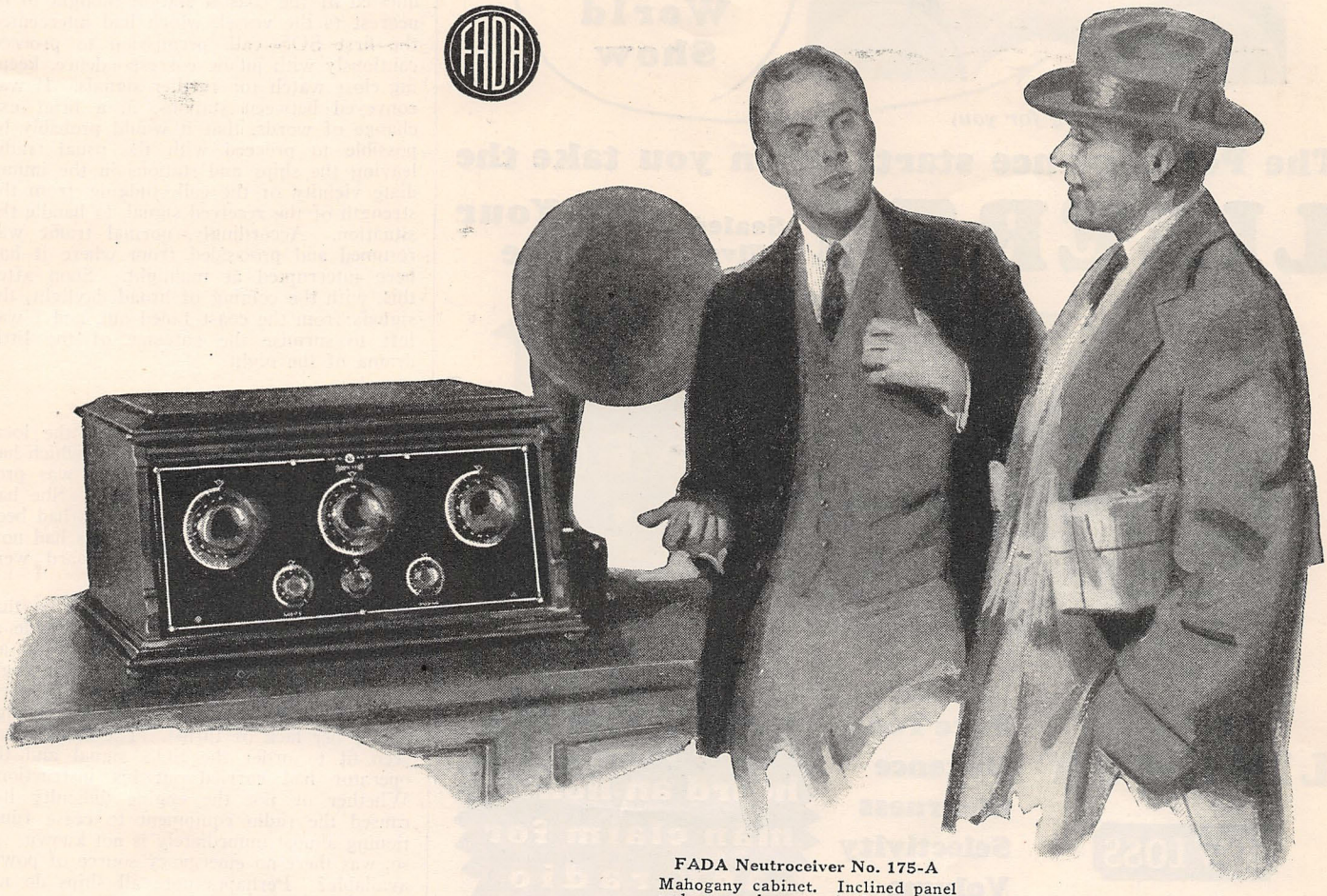
By HOWARD S. PYLE

THE other night I happened to be tuned in on 600 meters when one of the American freighters of considerable tonnage suddenly pierced the air with an SOS—that sharp, incisive call of the sea that immediately tenses thousands of listeners and sends little shivers of excitement and apprehension playing along the spine of even the old veterans of the key. The call was short, just the SOS followed by the call letters of the unlucky vessel. But it at once started in motion the rescue machinery of the sea, and in a very few seconds the powerful notes of several shore stations were booming out the command to all stations to give way for the distress messages, "QRT—SOS." Quickly the call was taken up by ships in various parts of the ocean, and in an almost unbelievably short time only the occasional splashing of static could be heard except for the frequent calls of the nearest shore station for the stricken vessel, and inquiries from a naval patrol vessel in the vicinity for information on the position of the distressed ship. But all to no avail. On the face of the circumstances it looked serious—just a sudden, short call for assistance and then—silence. Not the suggestion of the vessel's position, only the strength of her signals compared by varoius ships and shore stations served as a guide to her vicinity. A patrol craft racing in the general direction; several other ships slowed in mid-ocean, anticipating the possibility of rendering aid and all public service correspondence absolutely suspended—perhaps an area of fifty thousand square miles affected by that one sharp call.

THE LONG WATCH

Thousands of eager watchers, ashore and afloat, all straining their ears for the faintest signal that would aid in locating the luckless craft, but not one whisper disturbed the quiet. Occasionally a vessel would open with a timid inquiry, "Any news——" only to be immediately silenced by a crisp, "QRT" from several stations. And, unfortunately, an occasional interruption by an operator who did not seem to realize that a QRT—SOS

FADA Radio



FADA Neutroceiver No. 175-A
Mahogany cabinet. Inclined panel and roomy battery shelf. 5 tubes. Price (less tubes, batteries, etc.) $160.

Indecision vanishes when you hear the FADA

RADIO shopping ends triumphantly when you find the FADA. People who know radio and have conducted comparative tests say that the Neutroceiver is the best they have ever tried. Have the FADA Neutroceiver demonstrated in your home. Listen to its marvelously faithful reproduction. Tune in a distant station yourself loud and clear and see how easy it is. Observe the beautiful cabinet design. You will exclaim: "At last! This is just the set I have always wanted!"

If you prefer a set with self-contained loud speaker, the FADA Neutrola Grand meets your desire in this respect, as in all others. Whether FADA Neutrodyne receivers are the first or the fifteenth make you investigate, they will be your final choice. You need look no further. Through the FADA Neutrodyne your radio wishes become realities. See your dealer.

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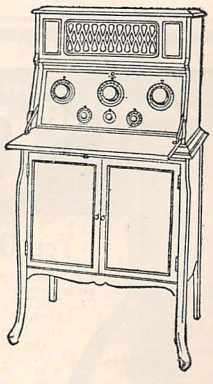
1581 JEROME AVENUE NEW YORK



FADA Neutrola Grand No. 185/90-A
The five-tube Neutrola 185-A, mounted on FADA Cabinet Table No. 190-A. Price (less tubes, batteries, etc.) $270.

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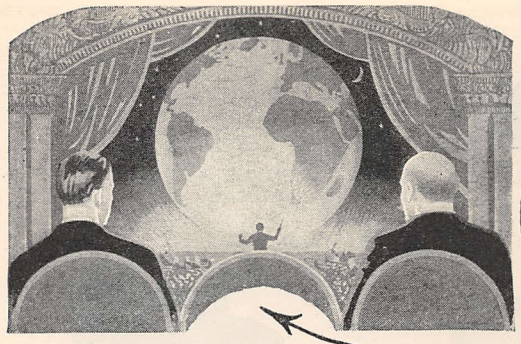

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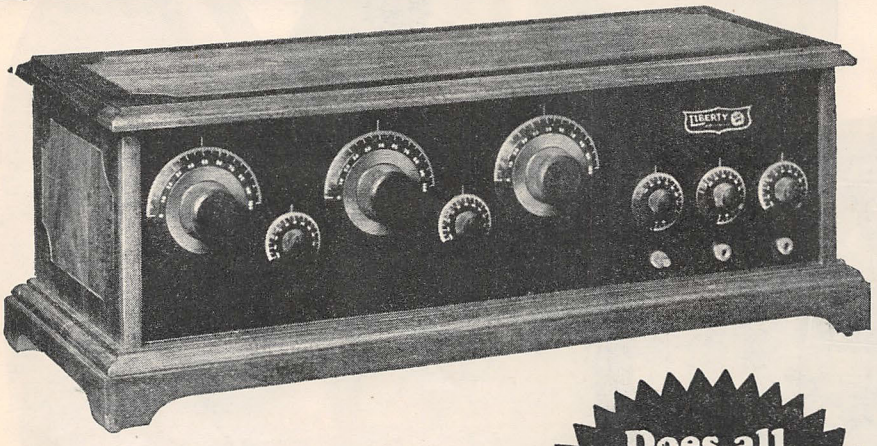

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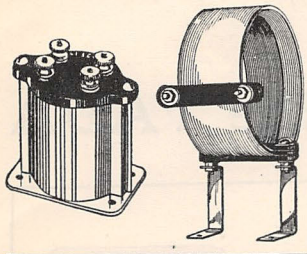

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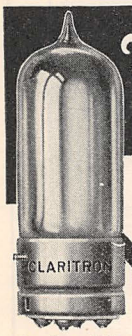

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Our No. 501A for same use as 201A Our No. 499 for same use as 199
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meant *absolute silence* except where transmission was of direct benefit to the distressed vessel or rescuing ships.

The vigil continued for exactly five hours, by my log, and occurred at the ideal time for long distance work—between midnight nd dawn, but not a sound from the freighter.

Finally, just as dawn was breaking, a coast station, growing uneasy at the long delay that had produced no results, requested of the coastal station thought to be nearest to the vessel, which had intercepted the first SOS call, permission to proceed cautiously with public correspondence, keeping close watch for further signals. It was conveyed between stations, in a brief exchange of words, that it would probably be possible to proceed with the usual traffic leaving the ships and stations in the immediate vicinity of the call, judging from the strength of the received signal, to handle the situation. Accordingly, normal traffic was resumed and proceeded from where it had been interrupted at midnight. Soon after this, with the coming of broad daylight, the signals from the coast faded out, and I was left to surmise the outcome of the little drama of the night.

TROUBLE

That evening, a short item in the local paper stated that the *S.S.* ———, which had sent an SOS the previous night, was proceeding safely and in no danger. She had encountered engine difficulty which had been the cause for the call for aid; this had now been repaired and conditions aboard were again normal.

Consider for a moment the effect of that SOS. An engine had developed trouble at sea. The ship was a large vessel, and although the seas were running rather high, she was probably in no immediate danger, although doubtless wallowing in the trough due to her lack of thrust. The captain had seen fit to order the SOS signal and the operator had carried out his instructions. Whether or not the engine difficulty had caused the radio equipment to cease functioning almost immediately is not known. If so, was there no emergency source of power available? Perhapes not; all ships do not carry the additional apparatus necessary. Perhaps the operator got off what signals he could while the equipment was in working condition. At any rate, the vessel's position—that most vital part of an SOS, and without which the rescuing vessels must grope blindly, was missing.

As a general rule, the operator of a seagoing vessel knows at all times his *approximate* vicinity, without the necessity of inquiring from the bridge. He at least knows whether the ship is somewhere off Bermuda or up among the ice-fields near Cape Race. Few vessels there are which do not send daily reports ashore, and consequently an operator with average intelligence will remember the approximate position given in the last daily report.

We are going to give the operator of the vessel in question the benefit of the doubt and assume that his equipment was put out of operating condition before he could transmit more than the SOS and the vessel's call letters. He had, therefore, done all within his power. But right here I'd like to raise a question. Which is of greatest importance the call letters of the vessel or its position? The law prescribes that the signal SOS shall be used in place of call letters and the distress call made in the form authorized for standard calling. This then means if we adhere strictly to the letter, that the distress call will comprise the following characters, "SOS SOS SOS de ABCD ABCD ABCD," preceded by the usual attention signal. This merely tells the listening world that ABCD is in distress and wants aid. Why not make

Balkite Battery Charger. Charges 6-volt "A" storage batteries.
Price $19.50
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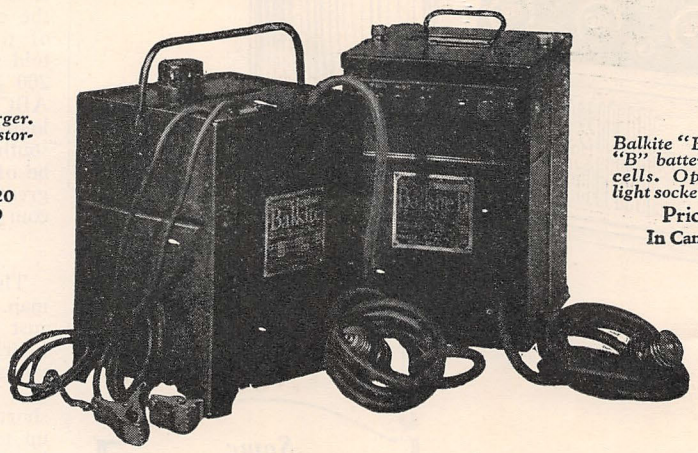

Balkite "B"—replaces "B" batteries and dry cells. Operates from light socket.
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give your set greater clarity, distance and volume

Your radio set will perform consistently only if your power supply is unfailing. Balkite Radio Power Units provide a convenient power supply that furnishes a constant, uniform voltage to both "A" and "B" circuits. The Balkite Charger keeps your "A" storage battery charged and operating at full efficiency. Balkite "B" replaces both "B" storage batteries and dry cells, and supplies plate current from the light socket.

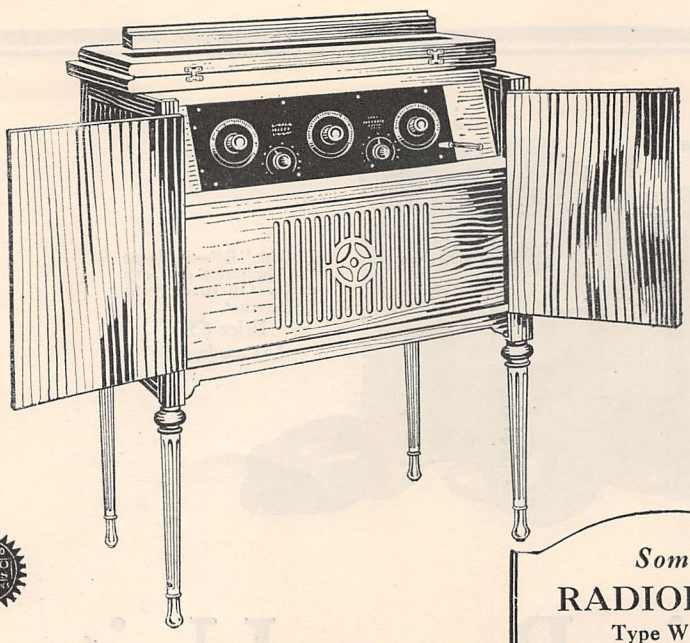
The Balkite Battery Charger and Balkite "B" are based on the same principle. Both are entirely noiseless in operation, have no moving parts or bulbs, have nothing to adjust, break or get out of order. They do not create disturbances in either your set or your neighbor's, require practically no attention, and can be put in operation at any time by merely connecting to the light socket. Their current consumption is very low. Both are guaranteed to give satisfaction.

Sold by leading radio dealers everywhere

FANSTEEL
Balkite *Radio Power Units*

BALKITE BATTERY CHARGER — BALKITE "B" PLATE CURRENT SUPPLY

Manufactured by FANSTEEL PRODUCTS COMPANY, *Inc., North Chicago, Ill.*



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At all good dealers.

Write for FREE diagrams of circuits in which Ambassador products can be used.

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To hear the natural tones of an artist's voice both in music and speaking, no Radio Instrument can compare with a crystal receiver.

With the VAN FIXED CRYSTAL Receiver your station is heard the instant ears and phones meet. First expense only. No batteries or tubes. Distance guaranteed with outside aerial 25 miles. A trial, you'r satisfied, and your friends will want one. Receiver only $3.50
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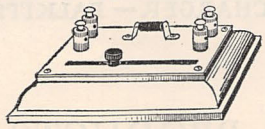
Not made to sell at a price but to give satisfaction.

Remember it has a FIXED CRYSTAL.



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HOLYOKE, MASSACHUSETTS

the distress call something after the following form, "SOS 200 SOUTH CAPERACE de ABCD, etc.," following with details of the trouble and other essential particulars, if the apparatus holds up long enough? In the event that interruption to the operation of the equipment occurred, more would be told in the few characters comprising "SOS 200 south Cape——" than in "SOS SOS de ABCD——." Rescuing ships would at least know that the ill-fated ship was 200 miles south of somewhere anyway which would be of considerable assistance, though not as great as if the whole story got across, of course.

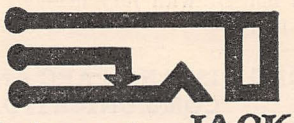
RESOURCEFULNESS NECESSARY

The captain of a vessel in danger is a busy man. He may throw to the wireless operator just a terse command, "Send an SOS, Sparks," and be gone. He doesn't care *how* you send it—the idea is to convey to rescuers in a way that will tell them the most in the shortest time. It is, in nine cases out of ten, up to the operator to figure it out. Often he is not given a position at the moment of receiving the order to send the call for aid. The captain cannot determine his position instantaneously. A resourceful operator will have an approximate knowledge at his grasp; from the former report or just a general location from his knowledge of direction, ports between which they are plying and the approximate speed they are making.

A moment's thought at such a time will often result in hours—maybe days—saved by rescuing crews. Think for a moment of the last vessel you exchanged TR's with. Suppose he had said, "About 300 miles from you, OM." Then your SOS in a very few characters could say, "SOS 300 XYZ——" meaning that someone is in need of aid and is 300 miles from XYZ. A ship coming to aid the stricken vessel would then only have to get XYZ's TR, and even if she found it necessary to guess whether north, south, east or west, could save precious hours by knowing in how big a circle to look for the damaged vessel from XYZ. Several ships co-operating in the search would find her in short order.

Another phase of the SOS I mentioned specifically, is the fact that because of the inability of other stations to establish communication with the freighter which transmitted the distress call, nothing definite could be learned of her predicament, and rather than take chances of interfering with her possible further calls, all other radio operation suspended for a period of five hours. We recognize, of course, that human lives are far above the value of dollars and cents, but with the newspaper report it is possible that the engine difficulty of the freighter placed her in no serious situation and that in some manner the wireless man could have managed to operate his transmitter on very low power long enough to either broadcast his position or clear the situation in some way so that a needless suspension of public correspondence might have been avoided. The holding up of traffic for such a period without a doubt cost a loss of at least several hundred dollars—probably thousands—in delayed messages. It would be interesting, though perhaps impossible, to compile figures on the monetary loss caused by exaggerated distress calls.

There is not much more to say. The vessel remained afloat, reporting the following morning that everything was again OK and the vessel proceeding as usual. It is hard to conceive of a real wireless man permitting no signal to be transmitted from his station for such a great period following an SOS call so vague and uncertain. This is, of course, readily apparent in the event of a vessel sinking, but where the ship remains afloat, there is a wide variety of temporary schemes for operating the transmitter. It


Anti-capacity **JACKS**

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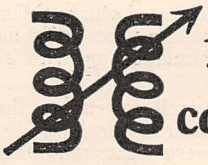
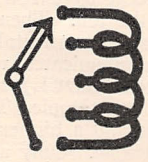

Lower-Loss **VARIO-COUPLERS**

Lower Loss *Variable* **GRID LEAKS**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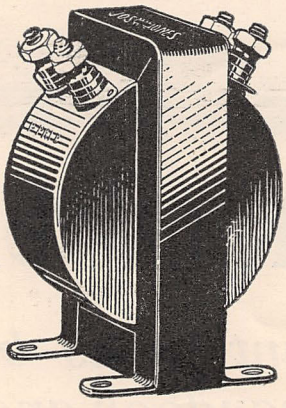

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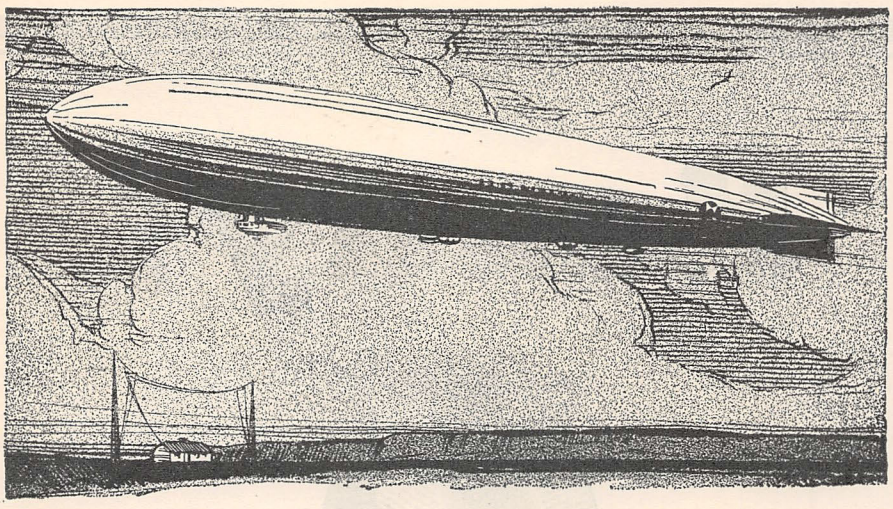

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Communication with land—under all conditions—at all times—this was the imperative need of the Shenandoah on its experimental flight across the continent. Impressed with this need, army and navy engineers equipped both transmitting and receiving sets with Dubilier mica condensers—not specially designed condensers but the regular standard product. Only complete confidence in the supreme reliability and efficiency of Dubilier condensers can explain their use in this important and daring adventure.

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is a wise operator who thoroughly familiarizes himself with jury methods and goes to sea prepared.

LONG DISTANCE ARC AND SPARK COMMUNICATION

Editor, RADIO NEWS:

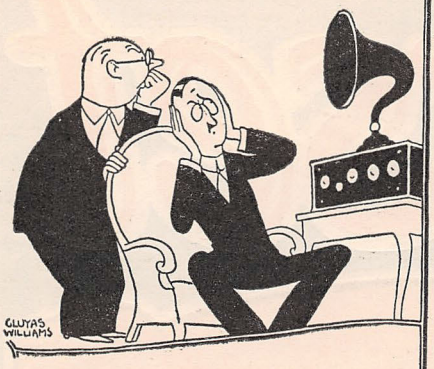
The letter written by the radio officers of the *S.S. Southern Cross* (KDTZ), and published in RADIO NEWS for January, brings to mind many pleasant experiences undergone while working with the *S.S. Southern Cross* and other Munson liners on the Southern route to Buenos Aires from New York City. Along with the timely article by Howard S. Pyle in the same issue it should prove very interesting indeed to a vast majority of the old time commercial operators who, like myself, have quit the game on account of the gradual influx of the "kid" element. It is to be regretted that commercial operating conditions afloat are not the same now as formerly, nor can they ever reach and retain the high standard once set at the latter part of the World War unless the Government of these United States takes a hand and limits the age at which the present day school graduate may be classed a professional in every sense of the word and, at the same time, installs a system of promotion contingent upon service and ability similar to the one now generally in use by the United Fruit Company. Laws and regulations should be expanded so as to govern and limit to a reasonable extent the conduct of the radio officers if the aforementioned plan is unfeasible. Radio room "society" and duties therein should be well defined at all times and radio men should be required to conduct themselves in a manner befitting their office and title.

The writer was a member of the operating staff at the naval radio stations Great Lakes and Bar Harbor, Me., when this latter station (NBD) was internationally famous for its high standard of efficiency in commercial as well as naval communications. I venture to say that no other commercial station on earth could remotely compare with NBD in its height of glory. Mention of two or three outstanding accomplishments of this station in communicating with ships at sea follow:

The writer well remembers the day when all world's records for long distance communication were shattered when the *S.S. Aeolus,* southbound to Rio de Janeiro from New York, consistently held and maintained direct daylight arc communication with NBD up to and including the distance of 3,013 miles. I might mention that the *S. S. Aeolus* was equipped with a two kilowatt Federal arc and this distance was greatly exceeded after nightfall. The distance is still unusual so far as I know even after dark, and seldom exceeded except by a few ships whose operators are on the job. Then again, using the five kilowatt spark set installed at NBD, the writer has communicated with the *S.S. George Washington* (KDCL) while this ship was nearing Constantinople, Turkey, later shifting to the arc and a higher wave-length for clearance of traffic. Only about one and one-half kilowatts of the five were in use at the time. Traffic has also been cleared to Bar Harbor from this ship while lying at anchor in the North Sea. Other occurrences of like character and equal merit could be placed herein, but time and space are limited.

It might be well to mention a few instances of memorable communication to the South and West of Bar Harbor. The writer personally, and on more than one occasion, has relayed traffic to NAT, New Orleans, from ships in the Gulf of Mexico which the shore station could not even hear. The same also has been done for KFS, San Francisco, and GKU, Assizes, England, for each of which

(*Continued on page* 1718)



Dear Jim:

So you've been bothered with battery noises.

When a battery leaks electricity between plates or across cell-tops it sure kicks up a row.

This unbalances the current in the set and you get the same spitting and cracking noises as with partly run down batteries.

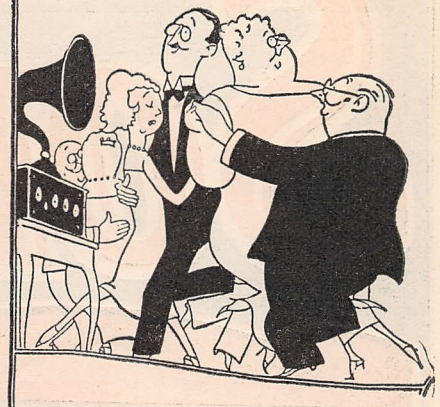
Willard Radio Batteries enable me to cut out these noises, and I can work on a full charge all the time, for Willards are *rechargeable*.

Their Threaded Rubber Insulation guards against leakage inside the battery, and their widely-spaced cells of glass with hard rubber tops say, "Halt," to current that tries to stray outside.

Willards are the only radio batteries insulated with Threaded Rubber. You'll find that they will make a tremendous difference in your set.

Your radio friend,

Sam.



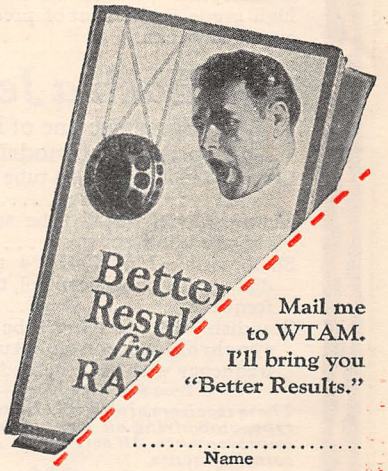
WILLARD RADIO BATTERIES

Every radio fan should have WTAM's booklet, "Better Results from Radio." This booklet tells how to get better results, how to clear up battery noises, and gives many other interesting facts that you should know. Not a technical book. Written so everyone can understand.

Write to WTAM

(The Voice of the Storage Battery)

for this booklet—



WTAM is the Radio Research Laboratory and Broadcasting Station of the Willard Storage Battery Company, Cleveland, Ohio.

Its function consists of research which is being done to improve the quality of radio reception and the broadcasting of radio programs for you entertainment.

Mail me to WTAM. I'll bring you "Better Results."

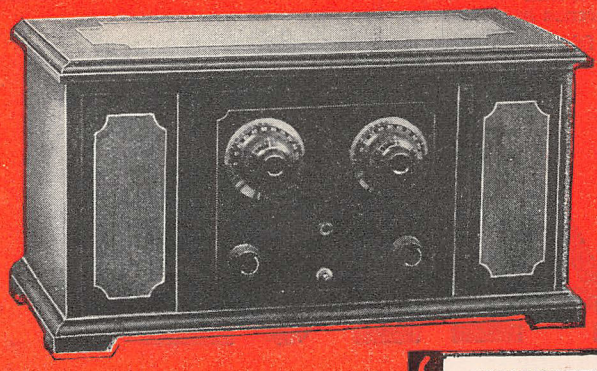
Name .....

City and State .....

Street Address .....

RN6

Somerset



SOMERSET STRATFORD MODEL 4A $65

SOMERSET STRATFORD Model 4A 4 Tubes—Dual Control. A superior four tube, tuned radio frequency receiver—two dial control—operates on storage battery or dry cells. Automatic filament control insures long life of tubes. The finest "low loss" condensers and the famous SOMERSET Calibrated Transformers are features. "A" and "B" battery space is provided in the handsome two-tone mahogany finish cabinet. Size 21"x15"x11". List $65

SOMERSET MARS MODEL 5A $75

SOMERSET MARS Model 5A 5 Tubes—Three Dial Control. Two stages tuned radio frequency, detector, and two stages audio frequency. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers and the famous SOMERSET Calibrated Transformers. Artistic cabinet hand-rubbed mahogany finish providing space for storage "A" and dry cell "B" batteries. Size 29"x14"x11". List $75

Treasure Chests —Full of Delights for You!

SOMERSET Radio Receivers represent a new Idea in radio—an honest price for honest materials and workmanship. In performance and results they have set a new standard of excellence and they fairly shout "Quality" in every line. Every set is a piece of fine furniture that any woman will welcome in her drawing room, a high grade instrument of precision that will fascinate any man.

Each a Jewel!

THE Somerset line of Radio Receivers comprises four models—

Stratford—Model 4A, 4 tube set, 2 dials, tuned radio frequency	$65
Mars—Model 5A, 5 tube set, 3 dials, tuned radio frequency	$75
Shelbourne—Model 4B, 4 tube set, 1 dial, synchronized control, tuned radio frequency	$85
Standish—Model 4C, 4 tube set, 1 dial, synchronized control, tuned radio frequency with built-in loud speaker	$150

Prices West of Mississippi—add 10%.

These receivers are all of the tuned radio frequency type, embodying all the newest radio engineering improvements. All sets have "A" and "B" battery compartments.

NATIONAL AIRPHONE CORPORATION
18 HUDSON STREET NEW YORK CITY

Truth in Radio

Prices subject to change without notice

Wonder Sets —in Wonder Settings

EVERY Somerset Radio Receiver is not only a marvel of engineering skill and master craftsmanship—truly "built like a watch"—but is also encased in a substantial cabinet of simple, artistic design, breathing distinction in every line. Note the unique two toned panel effect and the hand rubbed mahogany finish—quality is supreme.

A Challenge!

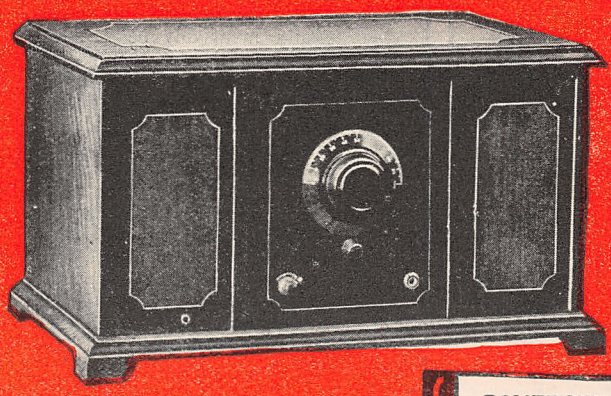
OBVIOUSLY—definitely—unmistakably superior in *quality*, Somerset Radio Receivers also lead the radio field in *value*—in worth for the money. Just check Somerset Radio Receivers feature for feature with any others at or near their price—*bar none!* You will be amazed—and you will appreciate the full force of our statement—

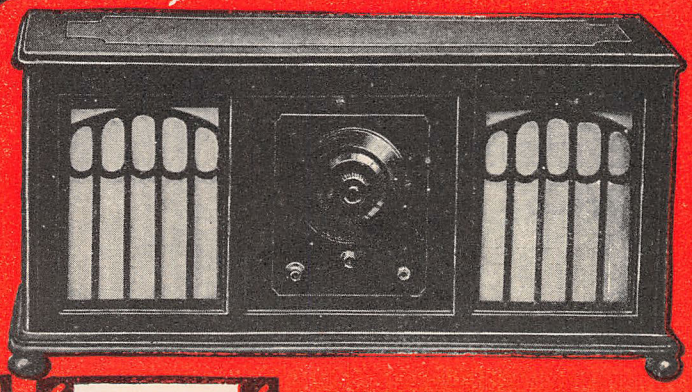
"Each Somerset Radio Receiver is the best that can be offered at its price; the utmost in results and permanent satisfaction to its owner."

NATIONAL AIRPHONE CORPORATION
18 HUDSON STREET NEW YORK CITY

Radio

Truth in Radio





SOMERSET SHELBOURNE MODEL 4-B $85

SOMERSET SHELBOURNE Model 4B 4 Tubes—Single Dial Control. Our perfected tuned radio frequency circuit with single dial synchronized control. Storage battery or dry cell operation, automatic filament control, the finest "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Compartments for large sized storage "A" and dry cell "B" batteries. Mahogany finish cabinet, hand-rubbed two-tone effect. Size 26"x 14"x12"..... List $85

SOMERSET STANDISH MODEL 4-C $150

SOMERSET STANDISH Model 4C 4 Tubes — Single Dial Control with built-in loud speaker. Combining a built-in loud speaker of the highest type and the four tube tuned radio frequency circuit with single dial synchronized control—all the latest and best in radio. Storage battery or dry cell operation, automatic filament control, highest quality "low loss" condensers, and the famous SOMERSET Calibrated Transformers. Ample space is reserved in this cabinet for standard size high ampere hour storage "A" batteries and dry "B" batteries. Exquisite cabinet, antique mahogany finish. Size 29"x13"x14". List $150

Radio Sets —With A Conscience

SOMERSET Radio Receivers are not *sold* until the Furchaser is perfectly satisfied. For back of every set is Somerset Service—more than mere good intensions—it is definite tangible aid, and yours for the asking. It is based on

The Famous Somerset Guarantee—

"YOU must be satisfied with this receiver or we do not want you to keep it. If for any reason you feel that it is not exactly as represented or that it has not the quality and value which you have a right to expect, we want you to return it for exchange or for refund of your original purchase price, whichever you prefer. We will cheerfully and promptly make good any Somerset Radio Receiver which does not fully measure up to your expectations. This guarantee means exactly what it says, without reservations, and is backed by the entire resources of this institution."

EVERY completed Somerset Radio Receiver must pass the rigid tests of the Somerset Engineering Laboratories before it can be certified "O.K." for shipment. And with each receiver is the Inspection tag bearing a record of these tests and signed by the inspectors. Look for it.

NATIONAL AIRPHONE CORPORATION
18 HUDSON STREET NEW YORK CITY

Truth in Radio

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Corp.

Somerset Features That Make Selling Easy!

1. Somerset Radio Receivers meet the popular demand for high quality at honest prices.
2. Somerset Radio Receivers cannot radiate or oscillate—the filament control is automatic—no potentiometer or stabilizer required.
3. Superior design gives clear, true, mellow tone without distortion—cannot squeal or howl—all body capacity effects eliminated.
4. Utilizing the highest grade "low loss" condensers and the famous Somerset Calibrated Transformers, extraordinary sensitivity and volume have been attained—securing wonderful range and local station reception without aerial.
5. Cabinets of surpassing beauty, gracing the most artistic surroundings—wiring and batteries concealed—everything accessible and conveniently arranged—sturdy construction, two-tone panel effect, hand-rubbed mahogany finish.
6. Made by a corporation of long experience in radio manufacturing with ample resources to insure the utmost in production economy and standing solidly behind every statement or claim—your assurance of reliability.

MAIL THIS COUPON TODAY

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18 Hudson Street New York City

Without any obligation to me, send me the Somerset Radio Primer and full details of Somerset Radio Receivers.

Name.....

Address.....

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New MODEL "C"

U. S. and Foreign Patents

"What a Difference the Hammarlund makes"

Stations never heard before—pleasing clarity—freedom from interference—are advantages the New Model "C" Hammarlund Condenser brings to you.

No watch was ever built with more precision.

The Model "C" is a *real* low-loss condenser—losses too small to be measured. Electrically and mechanically, it is above comparison.

Look for Hammarlund Condensers in the receiver you buy. Use only Hammarlund Condensers in the receiver you build.

All capacities; plain and vernier. Sold by the better radio dealers.

The Ultra-Vernier Dial, shown on the receiver in the illustration, is a new precision product of Hammarlund manufacture. Its 20 to 1 ratio provides fine tuning and gives the panel a distinctive air. $2.50 each at your dealers.

Write for interesting folder.

HAMMARLUND MANUFACTURING CO.
424-438 West Thirty-third Street, New York
Pacific Coast Representatives:
Atlantic-Pacific Agencies Corp.,
204-212 Rialto Bldg., San Francisco
Canadian Distributors: Radio, Ltd., Montreal

9 points of superiority

1. Soldered brass plates, chemically treated against corrosion; perfect alignment.
2. Stator plates specially shaped for easy tuning on low waves.
3. Adjustable ball-bearing rotor shaft, grounded through metal end-plates.
4. Soldered clock-spring pigtail, with automatic stop.
5. Minimum dielectric; losses too small to be measured.
6. Rugged, compact construction; cannot warp.
7. Micrometer vernier; moves all plates; no backlash.
8. Takes any size dial.
9. The product of 14 years' experience, making precision instruments.

For Better Radio
Hammarlund
PRECISION
CONDENSER

DeForest License

HONEYCOMB COILS

Back and Front Panel Mountings
Plain or Geared
Genuine Bakelite

The Universal all-wave inductance standard as to superior construction and electrical units. Ask your "Old Timer" radio friend why sets using honeycomb coils are better; they give closer tuning, greater selectivity and range. No dead end losses, easy to operate. 16 sizes, mounted and unmounted.
Send 25c for Super Heterodyne, Radio Frequency and Honeycomb Coil Circuits and Complete Catalog.
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Like Extra Mileage—Diamond Batteries Last Weeks Longer, But Cost No More!

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Buy them at your Dealers'. Write for Literature.

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Long Distance Arc and Spark Communication

(*Continued from page* 1714)

the writer has acted as intermediary from ships in the Pacific and Atlantic oceans, respectively. These are only a few of the many instances that can be set down. But what land station can compare even thus far? Very, very few, if any.

With regard to communication with WBN and WBH, as reported by the operators of the *Southern Cross*, I desire to say that consistent communication on arc waves with these ships was the rule during the whole of their run from New York to San Francisco. They could always be relied upon to keep us in touch with small freighters and other non-arc ships in Southern waters, traffic for which would invariably be routed through Bar Harbor. NBD formerly used a 20-kilowatt arc, controlled from a distance of about 27 miles. The station does not now enjoy the reputation it once held for distance and reliability. I believe that it still holds world's records for volume of commercial business and for number, also accuracy, of radio compass bearings furnished in a stated length of time. Belin, the famous French inventor of the Telephotograph, set up his apparatus there and received the first photograph ever sent across the Atlantic ocean, a likeness of General Pershing, then in Paris. Such a distinction is reserved only for a station with an established record.

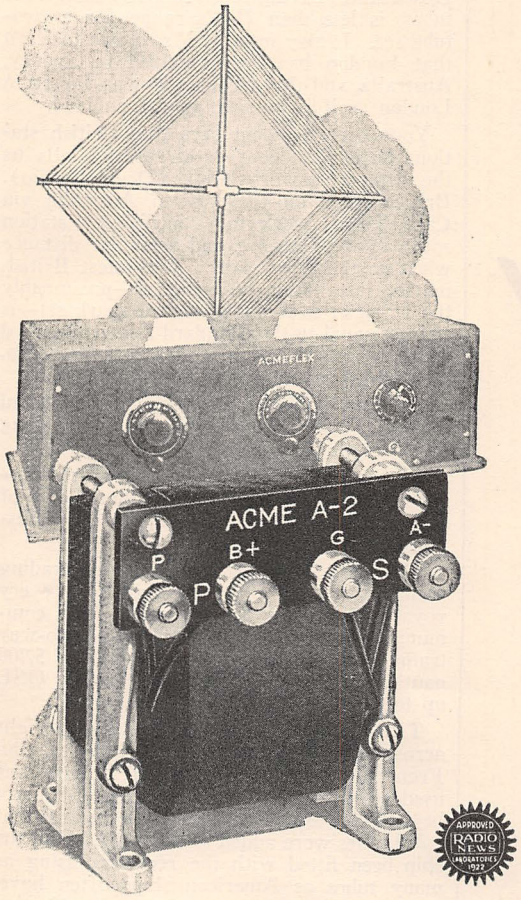
With all due regard to records, traffic and distance made by others, I firmly believe that the best average can proudly be set forth by the four Munson liners to South America, namely: *S.S. Pan America* (KDWZ), flagship of the fleet; *S.S. American Legion* (KDTM), *S.S. Southern Cross* (KDTZ), and *S.S. Western World* (KDYI). The writer, when on the *S.S. Pan America*, has cleared traffic, commercial and government, piled six inches high—weighted at that!—to the Bar Harbor Naval Station at a distance of about 4,000 miles, sending continuously for periods of 45 minutes for four and five hours, repeating only addresses and signatures, and obtaining a clean-cut, soul-satisfying receipt at the end of each 45-minute period. The *Pan America* uses only a two-kilowatt Federal arc, radiating about 12 amperes on 3,800 meters. Communication could usually be well established with NBD when at a distance off Cape San Rocque, Brazil, and short time arc communication has been entirely successful on several occasions while approaching anchorage in the harbor of Rio de Janeiro. Santos River-Mexican Gulf 600-meter spark work has frequently been done while the same location (Santos River) has been good for two-way arc communication with KFS (Frisco) and NAT (New Orleans). Those acquainted with this run and the average conditions met with will readily recognize the point of efficiency to which a two-kilowatt arc may be brought.

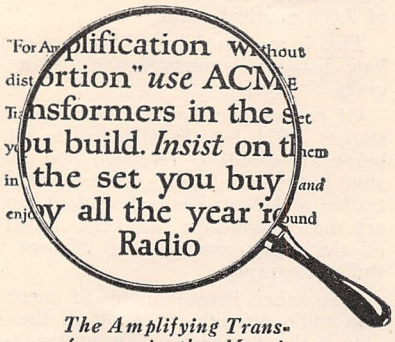
Distance work with the spark installations on the various Munson liners has been equally good as with the arcs. The old I.W.T. station at Easthampton, L. I. (WSA), probably holds all records for reliability and distance in 600-meter spark communication. The tone is distinctive.

The probability is that all records for average distance and all-around efficiency, both apparatus and personnel, can be in justice claimed by this four-ship combination on the 6,000-mile journey to Buenos Aires, Argentina.

PAUL EBERLE NELSON,
Ex-Chief Radio Officer,
U.S.M.S. Pan America.

Be sure — that your transformers are giving you Amplification *without* Distortion





The Amplifying Transformer is the Magnifying Glass of Radio

Acme Transformers give maximum volume of sound, clearly and distinctly

WHEN you put a lot of time and money into a radio set you want to be sure that it will give the best results. You want to know that your set will bring in the stations so that you can enjoy listening and be proud to call in your friends. You want Amplification, but above all you want Amplification without Distortion. Be sure to use amplifying transformers that increase the sound without spoiling the quality.

The Acme A-2 Audio Amplifying Transformer is the result of 5 years of research and experimenting. It gives amplification without distortion to any set. Whether you have a neutrodyne, superheterodyne, regenerative or reflex the addition of the Acme A-2 will make it better.

If you are not getting loud clear radio try Acme Transformers and note the difference.

Each transformer is tested and carries a guarantee tag. If you want Amplification without Distortion use Acme Transformers in the set you build and insist on them in the set you buy. (That's one of the big reasons why the Acmeflex Kit-set gives such good results—it uses Acme Transformers). Send for our 40-page booklet which explains how to get the best results by proper amplification and also contains a number of valuable wiring diagrams. It will help you build a set. Mail the coupon with 10 cents.

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. K1, Cambridge, Mass.

Have the fun of making your own radio set

ACME
~ for amplification

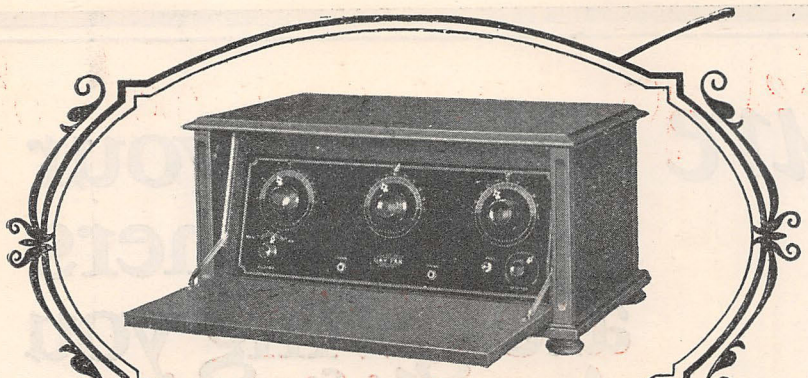
ACME APPARATUS COMPANY
Dept. K1, Cambridge, Mass.

Gentlemen:—
I am enclosing 10 cents (U. S. stamps or coin) for a copy of your book "Amplification without Distortion."

Name .....

Street .....

City ..... *State* .....



DAYOLA $125.

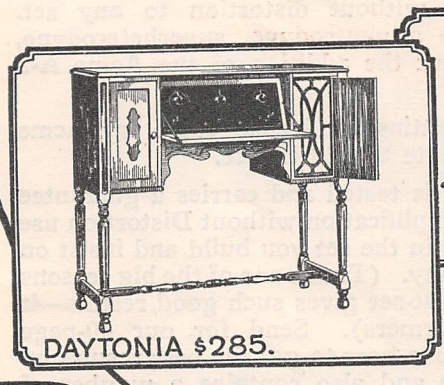
The Set that is Already Logged!

Every DAY-FAN set comes to you with a complete list of broadcasting stations with their corresponding dial settings.

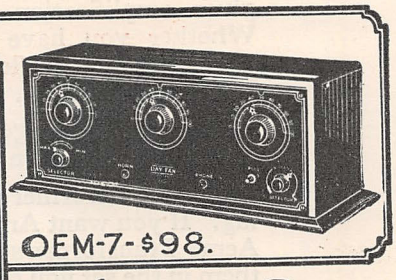
Select the station you want—turn the pointers to the positions furnished with the set—and listen. That's all that is necessary when you use a DAY-FAN.

The entire DAY-FAN line, comprising models priced from $90 to $285, has this new and exclusive feature.

THE DAYTON FAN & MOTOR CO.
Dayton, Ohio



DAYTONIA $285.



OEM-7-$98.

and other models

Day-Fan RADIO

A YEAR AHEAD

Operate your radio from your lamp socket with a

Gould Unipower Battery

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RADIO

Big, complete stock. Standard prices. And you're sure it's reliable if it comes from Andrae.

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ANDRAE *In Business Since 1860*

Triangle

PICK A CROSLEY WINNER

TRIANGLE RADIO SUPPLY CO., INC.
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The EAGLET Neutrodyne

3 TUBES
DRY CELL
$75

Write for Literature

WE SOAR ABOVE
EAGLE RADIO COMPANY
NEWARK NEW JERSEY

FROM AN AUSTRALIAN COMMERCIAL OPERATOR

Editor, RADIO NEWS:

In the September issue of your excellent journal, an article appeared entitled: "A Commercial Operator's Viewpoint," by Mr. F. Howe.

Mr. Howe seems to have a poor opinion of British radio, therefore the object of this letter is to defend it. The distance Mr. Howe states having received 2LO, using four tubes, is less than 2LO's range for a two-tube set. It may interest Mr. Howe to learn that London has been received in Sydney, Australia, and this city is about as far from London as it is possible to get on land.

Your correspondent says that British stations have very poor receivers and tells us the distance he works GKU (Devizes radio). British ships on the way to Australia via Cape Town, work this "inefficient" station south of the Equator, and a similar distance when on the Suez track. The latest British marine installation he criticizes—presumably the 1½-k.w. Marconi quenched spark set—is at least equal to the Standard 2-k.w. quenched spark set on American vessels, in appearance, workmanship and performance.

All the ships fitted with the Marconi Q.G. sets running to Australia, work long distances throughout the voyage.

As for the old Marconi rotary spark set—ridiculed by Americans and others—one of these sets hold a world's ship to shore distance record.

This set is fitted on a British ship trading from Sydney to San Francisco, and every voyage for years this ship has held communication with KPH (Bolinas), two-way traffic every night up to a distance of 5,200 nautical miles, and TR's, and direct QSL up to 5,964 miles.

TR's have been sent from the ship right across the distance from Sydney to San Francisco, but as only a single tube was used on the ship, KPH was not heard direct beyond the 5,964 miles. This means that 1,200 miles were added to the 5,964. Had the ship been fitted with the receivers using as many tubes as American ships often have, then, doubtless, the two-way communication would have held over the enormous distance of 7,000 nautical miles.

This is no "freak" working, but consistent long-distance communication taking place every voyage.

Of course, great credit is due to the coast station KPH, but the ship had to put it out before it could be received, and the same ship has worked long distances with Australian and New Zealand stations, and these are mostly one-tube receivers. Such is one of the many examples of efficient British radio telegraphy.

Two other items worthy of mention are two radio circuits operating in the Pacific. One is the Townsville (Queensland)-Rabaul (New Guinea) circuit. The distance between these two points is approximately 980 miles and C.W. tube sets with a power of 2-k.w. is used. The other—Awanni (N. Z.)-Apia (Samoa), a distance of 1,500 miles—is covered by a medium powered spark set. Both these circuits work a heavy traffic service in daylight under tropical conditions throughout the year.

Perhaps, when Mr. Howe has taken more than those three trips across the Atlantic, he will be good enough to give British radio the credit it deserves.

In conclusion, the writer wishes to say that some of the American coast stations are wonderful workers and, perhaps, the most popular are KPH, WCY and WIM.

VICTOR B. RIPPINGALE,
44 Margaret St.,
Sydney, Australia, N. S. W.

Build the Set you have dreamed of

TROPADYNE SUPERADIO OUTFIT

Superior to Super-Heterodyne

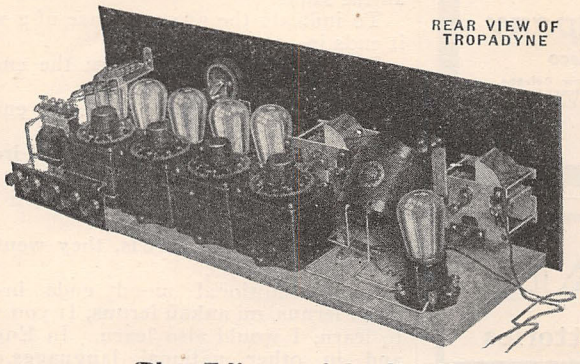
THIS Superadio 6 Tube Set brings in Station KFKX (Hastings, Nebraska), 1200 miles, in New York City, clearly on a loud speaker, using only the small loop which comes with the outfit.

The outfit advertised here is complete, as listed below, everything needed is included, down to the last screw. The charts, blueprints, directions and photos furnished are so complete and explicit that anyone can build this set and have it working within a few hours. There is nothing additional to buy except the necessary batteries and tubes. Price includes mahogany cabinet and folding loop aerial.

You can pay $150 or more for an outfit, or $200 or more for a set, but you cannot possibly buy a better set than this one.

NO. M4477

Your Money Refunded if this set does not satisfy you in all respects—if after 5 days' fair trial you do not proclaim the TROPADYNE the best radio set you ever listened to.



REAR VIEW OF TROPADYNE

Note These Important Features:

DISTANCE, VOLUME AND TONE QUALITY equal to any 8 tube set sold anywhere at any price.

LOOP RECEPTION—Outside aerial not to be used with this set—the complete loop is included in outfit.

PERMANENT LOGGING OF STATIONS—Follow chart furnished; there are only two tuning controls and you always find the same station at the same spots on the dials. Our log chart shows you at what point to find any station.

MICROMETER VERNIER DIALS giving you the full advantage of the exceptionally sharp tuning.

OUTFIT IS ABSOLUTELY COMPLETE—Drilled panel, Mahoganite Cabinet and everything else needed, except tubes and batteries.

ECONOMY and SIMPLICITY—This is not a reflex, yet six tubes do the work for which other sets require eight to ten.

The Editor of Radio News

In the August 1924 issue, said this about the **Tropadyne:** "Here is a remarkable receiver which we warmly recommend to our readers. It has several new and unusual features. In the first place only 6 tubes are used giving as much volume as the average 8 tube Heterodyne. The selectivity of this set is unusual. Unequalities of the intermediate transformers have now been done away with by tuning each transformer. After the transformer has been tuned, it can be left this way, no further tuning being necessary.

"This system makes for maximum sharpness and maximum volume. Another outstanding point of superiority of the Tropadyne circuit is that it practically does not radiate, thereby not interfering with other nearby receiving stations. A saving of two tubes as well as an increase of selectivity is obtained with this new circuit."

Complete List of Parts:

4 *RICO* Tropaformers; 1 Standard Variocoupler; 2 *Certified* Low Loss 23-plate Condensers; 1 *Calibrated* Transformer; 2 Jacks; 3 Fixed Condensers; 6 Bakelite Sockets; 2 Vernier Dials; 1 Rheostat; 1 Potentiometer; 1 7x24 Panel; 1 7x24 Mahogany Cabinet and Baseboard; 40 ft. Bus Bar Wire; 1 Folding Loop Aerial; 1 Grid Leak and Mounting; Binding Posts; Flexible Wire; 1 Bakelite Binding Post Strip; 4 doz. Screws; Full Directions.

RADIO SPECIALTY COMPANY, 98 PARK PLACE, NEW YORK

Tropadyne Gets Europe!

"Received 2BD, Aberdeen, on November 25th. Results good, except noises. 11:30 to 11:40 talk, from 11:40 to 12:00 piano number. Piano number good, talk poor. Used Tropadyne Circuit."

J. ZIMMER, 157 James St., Newark, N. J.

The above has been verified by "RADIO NEWS"

SEE OUR 2-PAGE AD ON PAGES 1618 and 1619 RADIO NEWS

RN3 **SEND NO MONEY**

RADIO SPECIALTY CO., 98 Park Place, New York, N. Y.

Please send at once one complete Tropadyne Superadio Outfit as advertised in February Radio News. I will pay postman or expressman $60.50 upon arrival.

NAME .....

STREET or R.F.D. .....

CITY ..... STATE .....

"All that could ever be desired in the way of satisfactory radio reception"

For Best Results, Be Sure You Get The BALDWIN-PACIFIC

45,000 CYCLE SUPER-KIT $15.00

U.S.S.Maryland.
Navy Yard Puget Sound Wash.
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Thousands Now Know This to be the Greatest Radio Value Ever Offered

Complete Super-Heterodyne Receiver May Be Built for $45.00

A remarkable value, made possible through huge quantity production. *Build your own Super-Heterodyne, or have your dealer build it for you.* Rebuild or convert your old set to a modern and advanced type Super-Heterodyne. All other parts required are standard. Hook-up print with complete and simple instructions packed with each "Pacific Quintet" kit. Foresight and Advanced Engineering Efficiency now bring the latest and most popular developments within a price range to suit the average pocket-book.

The Baldwin-Pacific Co.
Pacific Building.
San Francisco, California.

Gentlemen:-

In reply to your query of recent date as to the perf-ormance of my "Pacific-Quintet" equipt SUPER-HETERODYNE set, you are advised as follows.

The set is very easily tuned, and extremely quiet in operation, despite the fact that it is located in a room where even the furniture is of metal, and on board a ship where all the machinery is electric driven.

As to its selectivity! I find no difficulty whatever in tuning out CKCK on 420 meters, and bringing in KPO on 423 meters. Or in tuning out KFHR on 283 meters, and tuning in KFSG on 278. This without any interference whatever, and without employing the directive qualities of the loop.

The following stations were received on loud speaker with this set during the past week, Sept 14 to 22.

KFHR	KPO	KFAE
KGO	KFKX	KFSG
KTW	KFOA	CFDC
KFPT	KMO	CNRC
KGB	KDKA	CNRW
WFAA	CFAC	CFQC
KGW	KHQ	KFBL
WOAW	KFI	CKCD
KLX	KHJ	CKCK.

While not an authority on radio sets in general, or the SUPER-HETERODYNE in particular, it is my belief that this circuit, employing your "Pacific-Quintet" kit in its construction, will bring to the reasonable individual, all that could ever be desired in the way of satisfactory radio reception.

Very truly yours.
Lieut C.H.Forth.U.S.Navy.

The above letter is an example of many received certifying to the superior efficiency and marvelous performance of the "Pacific Quintet" Super-Kit.

Approved by Leading Dealers, Jobbers and Manufacturers Everywhere

Satisfaction Guaranteed
Finely finished merchandise built for real work.

"Pacific Quintet" Super-Het Kit
Consisting of 1 Pacific "Ranger" No. 30 Oscillator Coupler, 3 Pacific "Ranger" No. 25 Intermediate Frequency Transformers and 1 Pacific No. 20 "Ranger" Filter Transformer.

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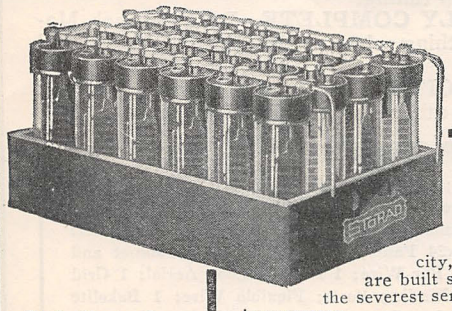

STORAD

STORAGE "B" Batteries

The Battery the Modern Receiving Set Requires

Satisfactory results with the new receiving sets can be obtained only with the use of large capacity, heavy duty storage "B" Batteries—batteries that are built special for this purpose in order to stand up under the severest service requirements. At the same time compactness is necessary.

The vital element, STORAD plates, are especially designed for this purpose and are 5/16" thick. These are separated by combination wood and rubber separators enclosed in specially molded glass jars and sealed with patented acid proof rubber caps.

4500 M.A.H.—24 volt No. 4524 4500 M.A.H.—48 volt No. 4548

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Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

A Course in Esperanto

(Prepared especially for Radio News, *by James Denson Sayers, Esperanto writer and editor, President New York Esperanto Harmonio Club)*

LESSON 3—VERBS

YOU have already learned the simple tenses of the verb, the infinitive, the present, past and future, but in order to have the entire conjugation of the verb in one place for convenient and quick reference in future, all the twelve conjugations are given here. It is not necessary to take up space with extensive delineation of each conjugation. The Esperanto verb, being entirely regular, is so simple in construction that a brief explanation, as the following, is all that the student needs for reading any Esperanto text. Keep your copies of Radio News with these lessons, and in future when reading Esperanto, or in writing to your Esperanto correspondents in other countries, if you find yourself in doubt about some point, refer to your lessons. I want to emphasize here the great value of immediately beginning to read as much Esperanto as possible, and of *taking up, at once, correspondence with Esperantists in other countries.* Besides the quick acquirement of facility and a true international style in Esperanto, your knowledge will be greatly aided, for great numbers of intelligent students in all countries are anxious to correspond in Esperanto. A little ad. in any one of the many Esperanto papers will bring you correspondents from all parts of the world. In Lesson 4, you will find a letter form; use it as a model, writing your letter in your own words, referring to your Esperanto dictionary for words you need. After finishing these few lessons, you will find surprisingly little need for the dictionary.

THE VERB

The verb (a word denoting action or state of being) does not change its form in Esperanto for person or number. First, second and third persons, singular and plural are all the same.

To indicate the present tense of a verb, it ends in—**as.**

To indicate the past tense the ending is—**is.**

To indicate the future tense the ending is—**os.**

mi iras, I go; **mi iris,** I went; **mi iros,** I shall go.

li iras, he goes; **li iris,** he went; **li iros,** he will go.

ili iras, they go; **ili iris,** they went; **ili iros,** they will go.

The conditional mood ends in—**us. Se vi lernus, mi ankaŭ lernus,** If you were to learn, I would also learn. In English and in other national languages, the moods are often formed by illogical tenses of the verbs, but you must be careful never to attempt similar forms in Esperanto. Here you will find all forms logical: If they *were* rich, they woud be happy. "Were" in this case does not mean that something has already happened in past time. It refers to a conditon that does not, but might exist—a conditional proposition. In Esperanto this is direct and logical: **Se ili estus riĉaj, ili estus feliĉaj.** Compound: **Se mi estus tie, vi estus vidinta min,** If I had been there, you would have seen me. (See participles **—anta, —inta, —onta** below).

The imperative (to command) mood ends in—**u. Lernu vian lecionon,** Learn your lesson. **Iru kaj portu la libron,** Go and carry the book.

The infinitive (indefinite) mood ends in **—i.** To be, **Esti.** To go, **Iri.**

(*Continued on page* 1725)

MURDOCK NEUTRODYNE

$100 *with built-in Loudspeaker*

THE Murdock Five Tube Neutrodyne is the outstanding 1925 model receiving set. You will be impressed by the beautiful tone quality and the rich cabinet design. There is space in the cabinet for "B" batteries and the only accessories necessary are batteries and tubes. A "Murdock" set is backed by our 20 years of successful experience in making radio apparatus.

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MURDOCK RADIO PRODUCTS

Standard since 1904

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The EXPERIMENTER, the one and only magazine expressly for the person who experiments, carries each month many pages of radio that detail the major problems of the industry that are waiting to be solved. The EXPERIMENTER covers completely the field of radio from the standpoint of the development of the industry.

A FEW TITLES OF RADIO ARTICLES FROM A PREVIOUS ISSUE OF "THE EXPERIMENTER" ARE SHOWN HERE.

MARCH ISSUE NOW ON SALE :: 25c THE COPY :: ON ALL NEWSSTANDS

Published by The Experimenter Publishing Company, 53 Park Place, New York, N. Y.

(*Continued from page* 1722)

The active participles (with an adjectival, substantival, or adverbial sense):

Present end in —anta, —anto, —ante.
Past end in —inta, —into, —inte.
Future end in —onta, —onto, —onte.

Examples: **La frato estas studanta,** The brother is studying. **Studanta knabo,** A studying boy. **Studanto,** A student.

Studante, oni lernas, By studying one learns, or, literally, **Studyingly,** one learns.

La viro estas parolinta, The man has spoken.

Parolinto, The speaker (naming a speaker of some past time). **Parolinte, li sidis,** Having spoken, he sat down.

La koncerto estas okazonta, The concert is about to occur.

La kantonto, The singer (who is just going to sing).

The passive participles (with an adjectival, substantival, or adverbial sense):

Present end in —ata, —ato, —ate.
Past end in —ita, —ito, —ite.
Future end in —ota, —oto, —ote.

Examples: **La poemo estas lernata,** The poem is being learnt. **La batato,** The person (or other object) being beaten. **Batate, li ekkriis,** Being beaten, he cried out. **La skribita letero,** The written letter. **Vidite, li forkuris,** Having been seen, he ran away.

All the forms of the passive voice are made by the aid of the verb **Esti,** to be (the only auxiliary verb in Esperanto), and a passive participle of the required verb.

La pordo estas fermata, fermita, fermota, The door is being shut, has been shut, is about to be shut.

The preposition with the passive is **de, by.**

Mi estas amata de mia patro, I am (being) loved by my father.

Ili estos sendataj de sia fratino. They will be sent by their sister.

VOCABULARY

Japanujo, Japan; **almenaŭ,** at least; **rigardi,** to look; **hieraŭ,** yesterday; **doni,** to give; **trancî,** to cut; **vidi,** to see; **eniri,** to enter; **krei,** to create; **per,** with, by means of; **persono,** person; **tiel,** so, thus, **ĉirkaŭ,** around, about; **peco,** piece; **stacio,** station; **turni,** to turn; **popolo,** people; **Dio,** God; **senfadena** (sen fadeno) wireless; **preta,** ready; **laŭte,** loudly; **mondo,** world; **pomo,** apple; **kiam,** when; **kaj,** and; **fermi,** to close.

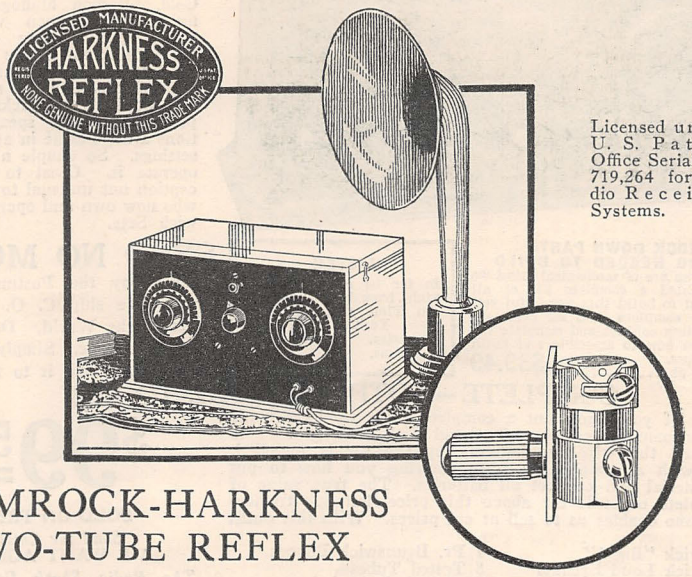
READING EXERCISE

Mi parolos morgaŭ al Japanujo per mia senfadena telegrafaparato. Oni diras ke almenaŭ tri milionoj da personoj estas pretaj paroli Esperanton. Rigardu al tiu viro parolanta tiel laŭte. Se li estus parolinta hieraŭ per la radio-telefono, oni estus aŭdinta lin ĉirkaŭ la mondo. Donu al mi pecon de la pomo trancâta. Donu al mi pecon de la pomo trancota. Ni estis irintaj (had gone) **al la urbo. Li estis ironta** (was about to start, to go) **al la radio-stacio kiam li estis vidata. Vidite, li ĉirkaŭ turnis sin kaj eniris la domon. Parolante, li staris antaŭ la popolo. La pordo estas fermita de la knabo. La mondo estas kreita de Dio.**

TRANSLATE TO ESPERANTO

In Japan many persons speak Esperanto. In Germany **(Germanujo)** more than a million persons have radio sets. One says that at least a hundred thousand buy sets each month **(monato).** Yesterday I talked to Dr. **(Doktoro)** Pierre Corret (8AE) in Versailles with my wireless telegraph set. He has a good, strong set. Dr. Corret is one of the **(unu el la)** best Esperantists in the

What makes possible such amazing clarity?



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SHAMROCK-HARKNESS TWO-TUBE REFLEX

LISTEN to it! Hear the Shamrock-Harkness for five minutes any time—even when receiving conditions are not most favorable. Above all, you'll be amazed at the way every sound comes in—clean-cut, life-like, clear as crystal! You can get *clear, consistent* loud speaker reception on this powerful little set within a radius of 1000 miles—and sometimes more!

Notice the unit pictured in the insert above. It's the crystal detector—the little wonder part that is responsible for this remarkable clarity.

Amazing Performance

The Shamrock-Harkness is astonishing the country. It combines the best features of the most powerful present day circuits—five-tube volume and distance combined with unequalled clarity. What a combination!

Only the genuine Shamrock parts will give you maximum results. Shamrock engineers have spent months in laboratory experiment designing these specially balanced parts. They are backed by our unconditional guarantee. Avoid all imitations—be sure to get a licensed Shamrock-Harkness Kit.

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Operates a loud speaker.
Two tubes do the work of five.
Cuts battery cost 60%.
Does not squeal, howl or radiate.
Stations can be logged.
Amazing clarity and volume.

PRICE
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SHAMROCK
FOR SELECTIVE TUNING

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Please send me a copy of "Shamrock Radio Builders' Guide Book," containing diagrams and complete instructions for building 10 sets at prices ranging from $15 to $50. I enclose 10 cents (U. S. stamps or coin).

Name .....

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BRUNSWICK "BIG 5" SET

5 TUBES

A truly Royal Set Combining Beauty of Design with Efficiency, Volume and Perfect Control. The Greatest Achievement of the most progressive year in Radio. A set a Millionaire would be proud to own. Well worth twice as much. Now cut to.....

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Just think of this list of BRUNSWICK Features: Mahogany Piano Finish Cabinet encasing a five tube set of pure Mahogany and Gold. Radion Mahoganite high finish panel upon which are mounted Mahogany and Gold Dials, Rheostat Knobs with Gold Markings, Gold Plated Switch which locks set when not in use, and Gold Plated Jacks, one for phones, one for speaker. Stations always come in at same dial settings. So simple a child can operate it. Coast to Coast reception not unusual to thousands who now own and operate Brunswick Sets.

KNOCK DOWN PARTS NOTHING NEEDED TO BUILD

For those who are of mechanical mind we have assembled a complete kit of all parts needed to build this wonderful set. The Kit is complete with all necessary tools, including cabinet and complete instructions on how to assemble and build in three hours. Guaranteed at $39.49

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For those of you who want a complete outfit we have made up a handsome set complete in detail with nothing more to buy. Even the wire for hooking up the set is included, together with a complete diagram showing you how to put up your aerial and connect all batteries. The true value of this complete outfit is far above this price, but our tremendous volume enables us to sell at cut prices. With this outfit you get:

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Please send me the outfit I have marked. When it arrives I will pay the Postman the amount. If I am not satisfied I will return it in 5 days in same condition as received and you agree to refund my money instantly. I have marked my choice in square.

(A) Brunswick "BIG 5" Set alone.....$64.50
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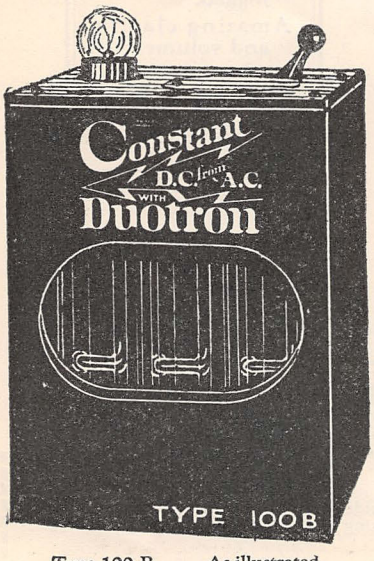

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DUOTRON requires practically no attention. Connect DUOTRON to your A-C lamp socket and it will keep up any Battery.

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world. I entered the station to speak by means of the wireless telephone. I turned and spoke to the people.

LESSON 4—THE PREPOSITION

Prepositions show the relation between parts of sentences, pointing out how something stands in relation to something else. **La birdo flugas al la arbo,** The bird flies **to** the tree.

Every preposition, but one, in Esperanto has a fixed and definite meaning, and great care must be taken to use the preposition which gives the exact meaning we wish to convey. A careful study of the list of Esperanto prepositions, with their English meanings, given in this lesson, will add greatly to your acquirement of the language.

The preposition **je** is the only one in Esperanto without a definite meaning. It should be used only when we have to employ a preposition and are uncertain which we ought to select. We can, however, omit the preposition, and put its complement (noun or pronoun) in the accusative case, provided no ambiguity is likely to arise through the presence of other accusatives in the sentence, as: **Li ĝojas je tio,** or **Li ĝogas tion,** He rejoices at (or, over) that. There is no Esperanto preposition which gives exactly the nuance of meaning of the English "at" or "over" in this sense. Such fine nuances of meaning, untranslatable, exist in all national languages, and as you progress with Esperanto you will realize how valuable is the indefinite **"je",** and also what wonders are accomplished by the accusative ending, which is often used instead of a preposition of any kind: **Li iris Londonon,** He went to London.

Unlike English, all prepositions in Esperanto govern the nominative case. If the complement of a preposition is in the accusative case, it is not owing to the preposition, but to the rule that the accusative is used to show the direction or place towards which movement (physical or moral) is made.

As already stated in Lesson 2, second paragraph, the accusative is used when direction is implied towards something. But if the word towards which such movement is implied is the complement of a preposition, then such word is in the nominative or accusative, in accordance with the following rules:

(a) If the preposition denotes of *itself* movement (there are just three such: **Tra, al** and **ĝis;** see second paragraph below), its complement will be in the nominative, in accordance with Rule 8 of Esperanto grammar that prepositions govern that case.

(b) If the preposition does *not of itself* denote movement, then movement is shown by placing its complement in the accusative.

PREPOSITIONS WHICH ALWAYS DENOTE MOVEMENT

The following three prepositions invariably denote movement, and consequently their complement is never in the accusative: **Al,** To, towards, **Ĝis,** Up to, as far as. **Tra,** Through.

To show duration of time, where better euphony is obtained by leaving out **"dum",** while, during, the accusative ending is used: **Li parolis du horojn,** He spoke for two hours.

The accusative is used to show weight, measure, or distance: **Li iris du mejlojn,** He went two miles. **La pano pezas du funtojn,** The bread weighs two pounds.

COMPOUND WORDS

Compound words are formed by joining the various root-words together, the

(*Continued on page* 1729)

NEW!

"B" CURRENT FROM THE ELECTRIC LIGHT SOCKET

SWITCH it on! Switch it off! That's all you have to do. No "B" batteries to charge or replace—No bother or nuisance—No trouble or disappointments—No guess work about your plate voltage.

Here's a magic box that takes your ordinary AC house current and converts it into direct "B" current of the proper voltage to operate your radio set at maximum efficiency—today or a year from now.

It doesn't run down or get weak—doesn't need new parts. It's as easy to operate as an electric iron, and should last just as long.

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9. Constant voltage — plenty of pep.
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11. It is NOISELESS—there's absolutely no hum or distortion.
12. Will operate low power transmitting sets.

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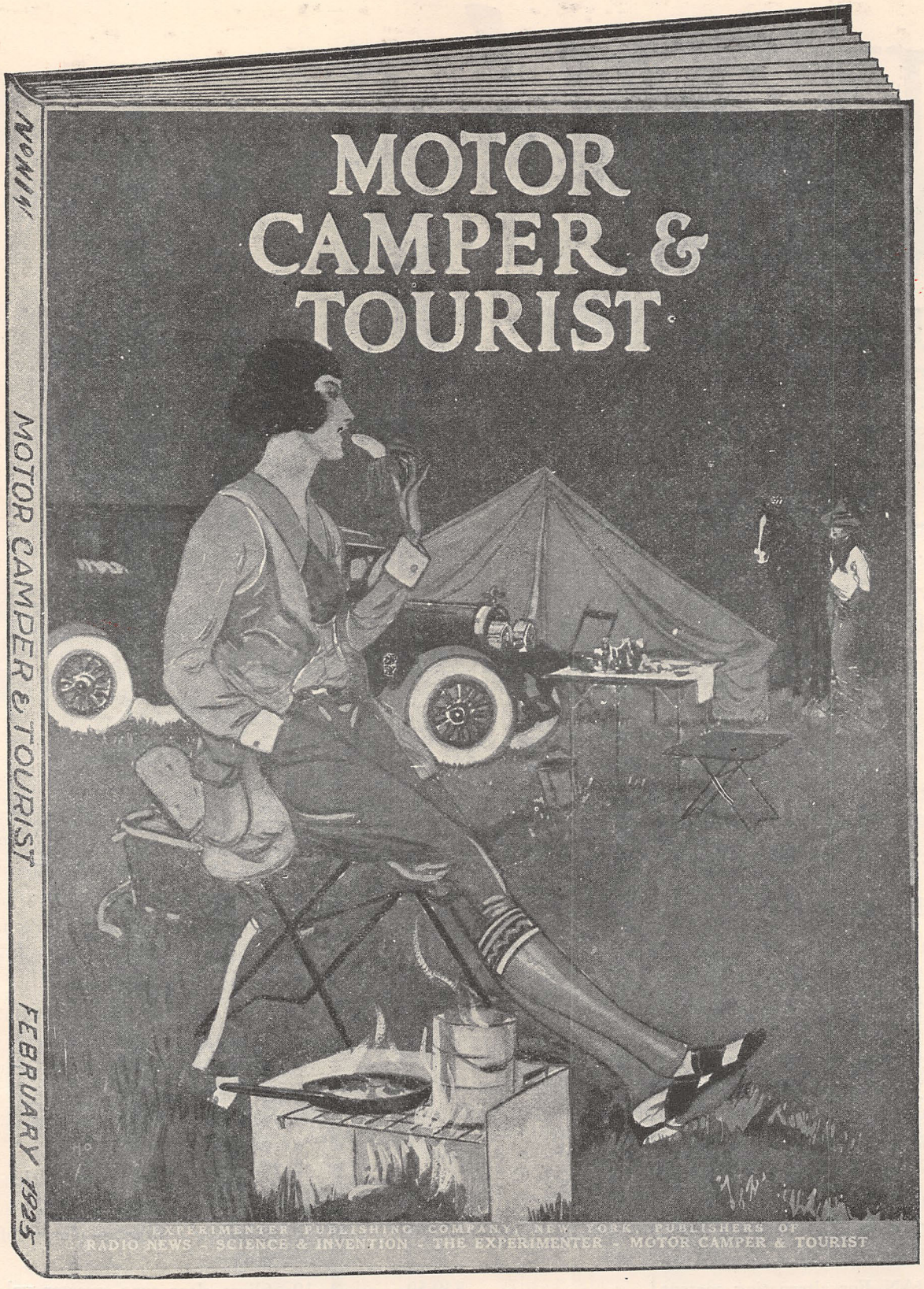

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February Issue of MOTOR CAMPER & TOURIST Now On Sale.

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(*Continued from page* 1726)

qualifying root-word or words coming first and the chief root-word coming last: **Vaporŝipo**, steamship; **legolibro**, reading book; **fervojo**, railway (from **fero**, iron, and **vojo**, way or road).

Word-building on these lines is very frequent in Esperanto, and does away with the necessity of learning a vast number of words. **Lerni**, to learn; **Lernanto**, one who is learning, a student; **lernado**, learning (the continued act of learning); **lernejo**, a school (from **lerni**, to learn, and **—ej**, the suffix meaning place, or location) a place of learning. (All the affixes, with treatment of their uses will be given in a later lesson). **Lernantaro**, a collection of learners, a student-body. A great variety of meanings can be built on "**lern—**", or any other root. Imagine a person knowing 2,000 of the Esperanto root-words, with half of them capable of such expansion! Such a person would have a vocabulary of a very minimum of 50,000 words. Compare this with Elbert Hubbard's 22,000 and Shakespeare's 15,000 and you will begin to have a dim idea of the tremendous literary and scientific riches of Esperanto.

FOREIGN, OR CLASSICAL WORDS IN ESPERANTO

A large number of words, mostly of Latin or Greek origin, exist, which are common to most languages. These words, after being made to conform to the rules of Esperanto phonetic spelling, may be used. They take the usual endings: **Telefono, Telegrafo, Centro, Aeroplano, Markonigramo, Opero, Teatro, Parko, Naturo, Karaktero, Aparato, Mikrofono, Lampo** (lamp, used for radio vacuum tube).

All international scientific and technical terms are thus treated and adopted into Esperanto.

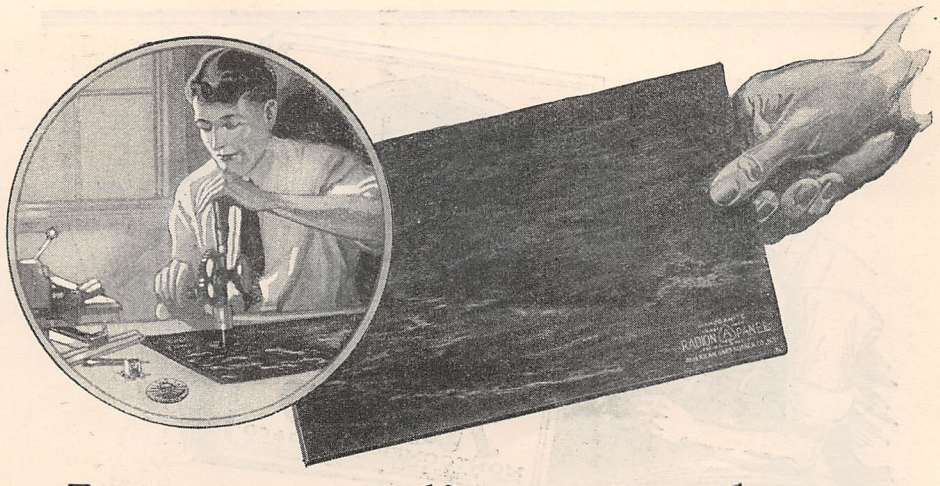
LIST OF PREPOSITIONS

The following is a list of the 35 simple prepositions in Esperanto, with their English definition:

al, to, towards; **antaŭ ol**, before (in point of time); **ĉirkaŭ**, about, around; **dum**, during, while; **anstataŭ**, instead of; **apud**, beside, close by; **da**, of (relating to mass quantity); **ekster**, outside; **antaŭ**, before, in front of; **ĉe**, at, with; **de**, of, from, by; **el**, out of; **en**, in; **je** (indefinite); **kun**, with; **per**, by means of; **post**, after, behind; **pro**, because of, for; **sub**, under; **tra**, through; **ĝis**, till, as far as; **kontraŭ**, against, opposite; **laŭ**, according to, along; **po**, at the rate of; **preter**, beyond, past; **sen**, without; **super**, above, over; **trans**, across; **inter**, between, among; **krom**, besides, except; **malgraŭ**, nothwithstanding; **por**, in order to, for; **pri**, concerning, of, about; **spite**, in spite of; **sur**, on.

The following is a reading exercise in which some of the prepositions and the accusative of direction are illustrated. The exact translation follows the exercise in order that the students may more quickly and clearly grasp these important points in Esperanto. These illustrations are taken from Cox's Commentary (published by The British Esperanto Association), which is one of the best textbooks of Esperanto for English-speaking students.

(1) **Ciuj prepozicioj per si mem postulas ĉiam nu la nominativon.** (2) **Se ni iam post prepozicio uzas la akuzativon, la akuzativo tie dependas ne de la prepozicio, sed de aliaj kaŭzoj.** (3) **Ekzemple: Por esprimi direkton, ni aldonas al la vorto la finon N; sekve: tie = "en tiu loko," tien = "al tiu loko"; tiel same ni ankaŭ diras: "La birdo flugis en la ĝar-**



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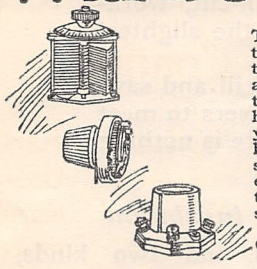

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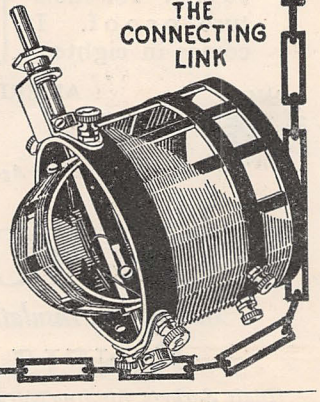

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denon, sur la tablon," kaj la vortoj "ĝardenon," "tablon" staras tie ĉi en akuzativo, ne ĉar la prepozicioj "en" kaj "sur" tion ĉi postulas, sed nur ĉar ni volis esprimi direkton, tio estas, montri, ke la birdo sin ne trovis antaŭe en la ĝardeno aŭ sur la tablo kaj tie flugis, sed, ke ĝi de alia loko flugis al la ĝardeno, al la tablo (ni volas montri, ke la ĝardeno kaj tablo ne estis la loko de la flugado, sed nur la celo de la flugado); en tiaj okazoj ni uzus la finiĝon N tute egale ĉu ia prepozicio starus aŭ ne. (4) Morgaŭ mi veturos Parizon (aŭ en Parizon). (5) Se ni bezonas uzi prepozicion kaj la senco ne montras al ni, kian prepozicion uzi, tiam ni povas uzi la kumunan prepozicion "je". (6) Sed estas bone uzadi la vorton "je" kiel eble pli malofte. (7) Anstataŭ la vorto "je" ni povas ankaŭ uzi akuzativon sen prepozicio. (8) Mi ridas je lia naiveco (aŭ, mi ridas pro lia naiveco, aŭ, mi ridas lian naivecon). (9) Je la lasta fojo (aŭ, la lastan fojon) mi vidis lin ĉe vi. (10) Mi veturis du tagojn kaj unu nokton. (11) Mi sopiras je mia perdita feliĉo (aŭ, mian perditan feliĉon).

TRANSLATION

(1) All prepositions by themselves always require the nominative only. (2) If we ever, after a preposition, use the accusative, the accusative there (in that case) depends not on the preposition, but on other causes. (3) For example: In order to express direction we add to the word the termination N as follows: **tie** = "in that place" (there), **tien** = "to that place" (thither); thus in the same way we also say: "The bird flew into the garden, upon the table," and the words **"ĝardenon", "tablon"**, stand here in (the accusative, not because the prepositions **"en"** and **"sur"** require this, but only because we wished to express direction, that is, to show that the bird was not (did not find itself) previously in the garden or on the table and flew (about) there, but that it flew from some other place to the garden, to the table (we wish to show that the garden and table were not the place of the flying, but only the destination (aim, purpose) of the flying; in such cases we should use the termination N all the same whether any preposition were there (should stand) or not. (4) Tomorrow I shall travel to Paris (or, into Paris). (5) If we need to use a preposition, and the sense does not show (to) us what preposition to use, then we can use the general (common) preposition **"je"**. (6) But it is well to use the word **"je"** as seldom as possible. (7) Instead of the word **"je"**, we can also use an accusative without a preposition. (8) I laugh *at* his simplicity (or, I laugh *because of his* simplicity, or, I deride his simplicity). (9) On the last occasion (or, last time) I saw him with you. (10) I traveled two days and one night. (11) I sigh *for* (I bemoan) my lost happiness.

SAMPLE LETTER FORM

Novjorko, Usono,
10-an de januaro, 1925.

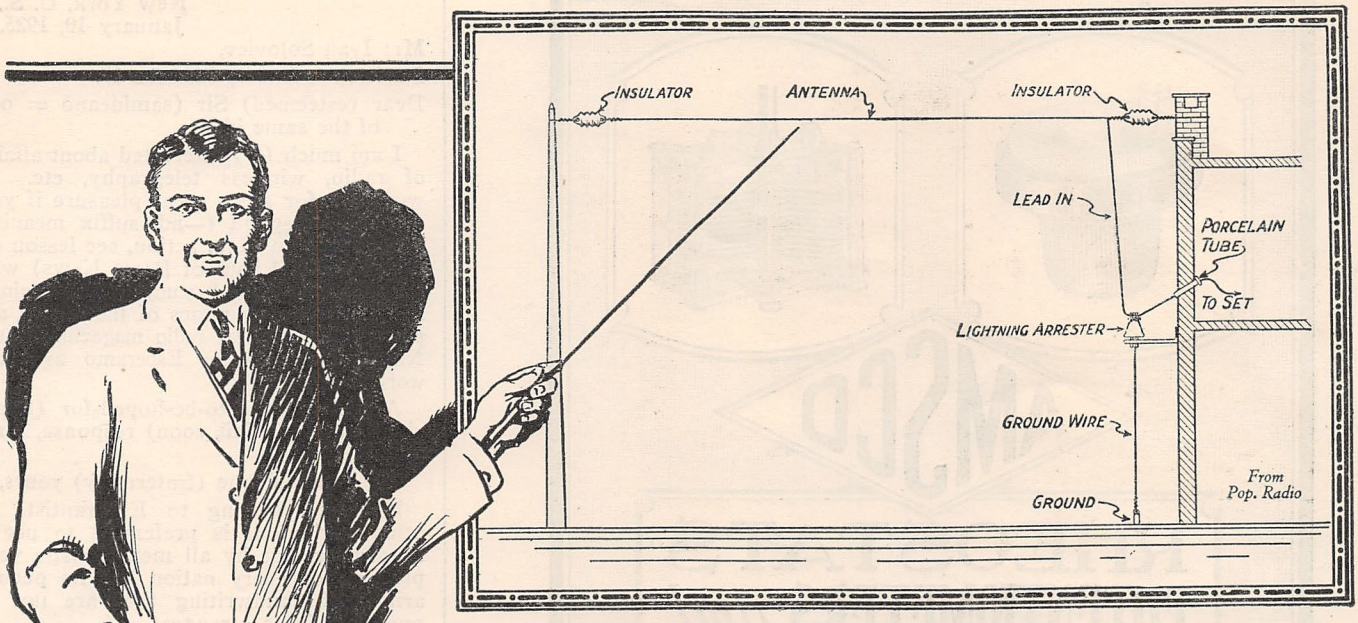
Sinjoro (aŭ, s-ro) Ivano Soloviev,
Simferopol, Rusujo, Bitakska 17.

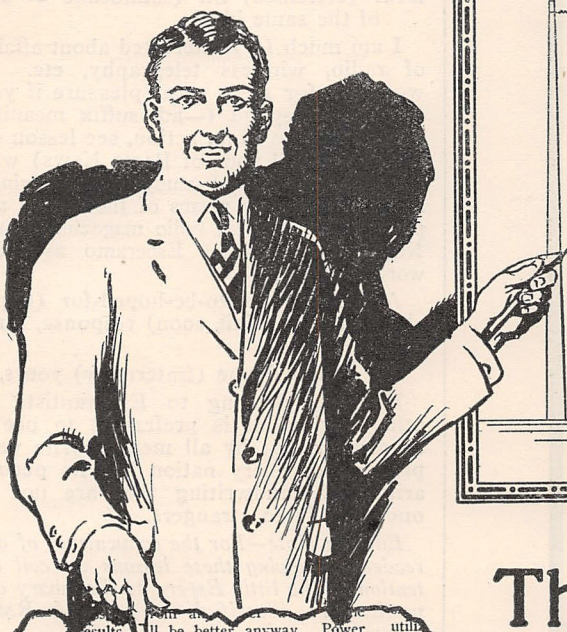
Estimata samideano:

Mi estas multe interesata pri aferoj de radio, senfadena telegrafo, ktp (kaj tiel plu). Estus por mi tre granda plezuro se vi povus korespondadi kun mi en Esperanto. Mi studas Esperanton nun per la lecionoj aperantaj en la granda radio revuo, RADIO NEWS (Radio Novaĵoj) kiu favoras Esperanton kiel radio-mondlingvon.

Atendante vian espereble baldaŭan respondon, mi restas.

Samideane la via.





results will be better anyway. Power lines in close proximity to an antenna cause a shadowing effect or an absorption effect and sometimes both.

Corroded Antenna Wire Causes Weak Signals

If your antenna has been up for a year or more the chances are that the surface of the antenna wire has become corroded due to the action of the weather. Radio frequency currents travel on the surface of the wire and often the weakening signals carried by them is due to this corrosion. This trouble is particularly prevalent in large cities where the atmosphere is contaminated with sulphur fumes and other chemicals from manufac[turing] plants.

Enameled wire is excellent for antennas as the enamel protects the surface of the copper from the gases and other corrosive elements in the atmosphere.

Clipping from Popular Radio

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the aerial and lead-in should be a continuous length of Beldenamel Aerial Wire. Use a 150-foot length furnished in standard Belden carton and avoid all joints.

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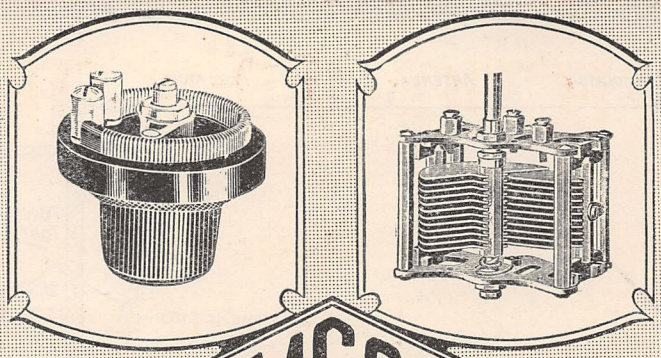

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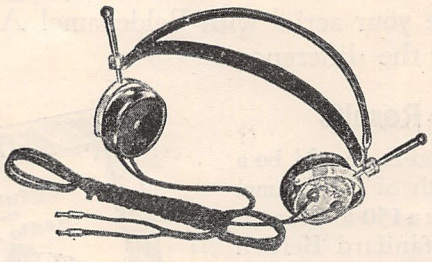

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TO THE RADIO DEALER

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EXPERIMENTER PUBLISHING COMPANY, 53 PARK PLACE, NEW YORK CITY

TRANSLATION

New York, U. S.,
January 10, 1925.

Mr: Ivan Soloviev,
Simferopol, Russia, Bitakska 17.

Dear (esteemed) Sir (samideano = one of the same idea):

I am much (ly) interested about affairs of radio, wireless telegraphy, etc. It would be for me a great pleasure if you would correspond (—**ad**, suffix meaning a continuation of an action, see lesson on affixes in April issue of RADIO NEWS) with me in Esperanto. I study (am studying) Esperanto now by means of the lessons appearing in the great radio magazine, RADIO NEWS, which favors Esperanto as radio world language.

Awaiting your to-be-hoped-for (hopeable) early (**baldaŭ**, soon) response, I remain,

Samideane (fraternally) yours,

Note—In writing to Esperantists of other nations it is preferable to use a typewriter, but by all means, write very plainly, for every nation has its peculiarities of handwriting that are not at once legible to strangers.

Editor's Note—For the convenience of our readers following these lessons we call attention to the little Esperanto dictionary advertised in Classified columns of RADIO NEWS.

Book Review

THE AMATEURS' BOOK OF WIRELESS CIRCUITS. By F. H. Haynes, Assistant Editor of *Wireless World* and *Radio Review*. Stiff paper cover, 6 x 10 inches. Diagrams. 124 pages. Published by the Wireless Press, Ltd., 12 and 13 Henrietta St., Strand, London, W. C. 2. Price 3/6.

The author first presents a few excellent pages dealing with general considerations of the properties and operations of circuits. As is usual, he tells first of the simple crystal set, then the single tube circuits, the different methods of amplification and several pages are devoted to transmitting circuits. This introduction is well done, serving its purpose as a preface to the main part of the book, which consists of circuit diagrams and their explanations. There are circuits in the first part showing different methods of connecting switches in circuits, the fundamental wiring of the vacuum tube with its accessories. Not only schematic, but also picture diagrams are employed, simplifying the circuits to a great extent. The diagrams progress through the single tube to the multi-tube circuits, and there are interspersed throughout many valuable suggestive circuits for the experimenter. Also there are included six tables in which are collected data on coils, their properties when connected with different sizes of condensers; wire data and the characteristics of tubes. We can recommend this book to the dyed-in-the-wool radio fan, who experiments, as a handy and well-written reference.

CAPTAIN ECKERSLEY EXPLAINS, a Reply to His Numerous Correspondents. By P. P. Eckersley, Chief Engineer of the British Broadcasting Co., 5 x 7½ inches. Paper cover, 86 pages. Diagrams and illustrations. Published by The Wireless Press, Ltd., 12 and 13 Henrietta St., London, W. C. 2. Price 2 shillings, net.

Needless to say the chief engineer of a broadcast company receives such a quantity of mail that it is impossible for him to even supervise the replies. As many of the letters are of a similar nature, Captain Eckersley adopts an excellent plan in publishing his answers to many questions in this well written and interesting little book.

Captain Eckersley first relates the history of broadcasting in England, telling of the problems in the choice of sites for stations, and other matters relating to the foundation of the British Broadcasting Co. The three remaining chapters deal with strength of signals, interference and faithfulness of reproduction.

Even though the American B. C. L. has not written to Captain Eckersley, he will gain from this book many excellent ideas for the perfecting of his own receiver and also some of the problems with which our British colleagues are confronted.

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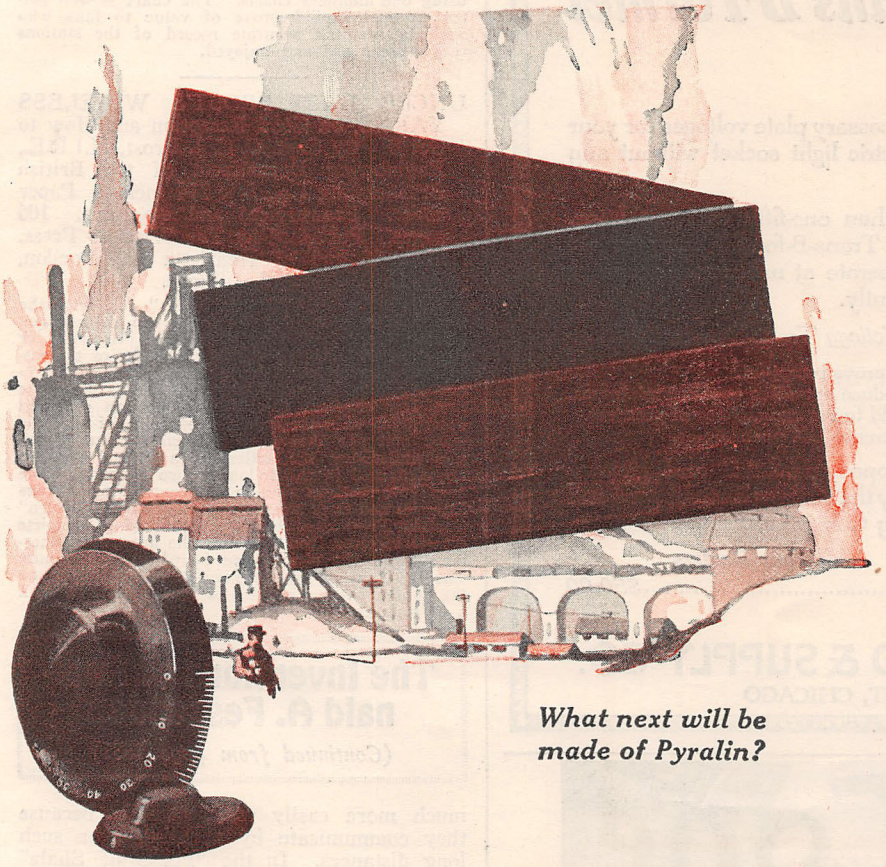

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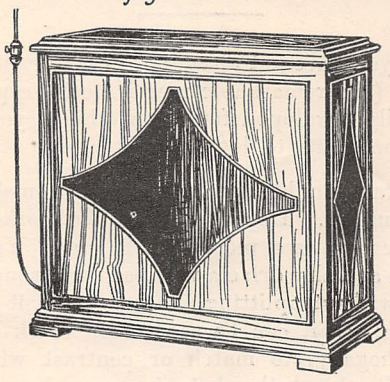

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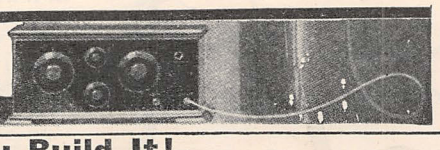

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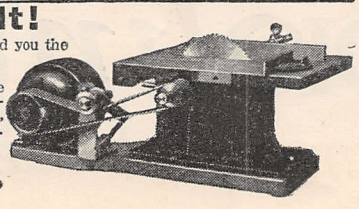

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"FIND-ME-QUICK" Radio Chart. By Felix M. Locher. Printed on ledger linen paper, 23 x 11 inches. Published by the International Radio Chart Exchange Bureau, 211 Patterson Building, Fresno, California.

The "Find-Me-Quick" Radio Chart has sufficient space for logging 100 broadcast stations. The columns for logging data are headed, "Call Letters," "Name of Station," "Location," "Dial Positions," "Loop" (Geographic Direction), "Wave-Length," "Watts," "Date and Hour Found" with "Remarks." There has been established a chart exchange bureau, whereby radio listeners who have similar sets may exchange information by using one anothers charts. The chart is well gotten up and should prove of value to fans who wish to keep an accurate record of the stations they have heard and enjoyed.

UNCLE JACK FROST'S WIRELESS YARNS, on Good Reception and How to Get It. By Capt. C. C. J. Frost, M.I.R.E., Engineering Department of the British Broadcasting Co., 5 x 7½ inches. Paper cover. Frontispiece and diagrams. 106 pages. Published by The Wireless Press, Ltd., 12 and 13 Henrietta St., London, W. C. 2. Price 2 shillings.

Captain Frost's "Wireless Yarns" deal with the fundamental principles of radio, up to and including the crystal set. They are primarily for the great majority of listeners who desire to master the general fundamentals of the science without being bored with technical details. In the first few chapters the author gives an excellent description of wave-length, amplitude of a radio wave and the theory of antennae. The principles underlying the action of a crystal detector are contained in the following two chapters. The next few sections contain information on storage batteries and their maintenance. In the last "yarn" Captain Frost describes the action of a complete crystal receiver from the time the antenna is energized until the signals are heard in the phones. The 12 "yarns" are a very clear exposition on the fundamental principles of radio reception with a crystal set.

The Inventions of Reginald A. Fessenden

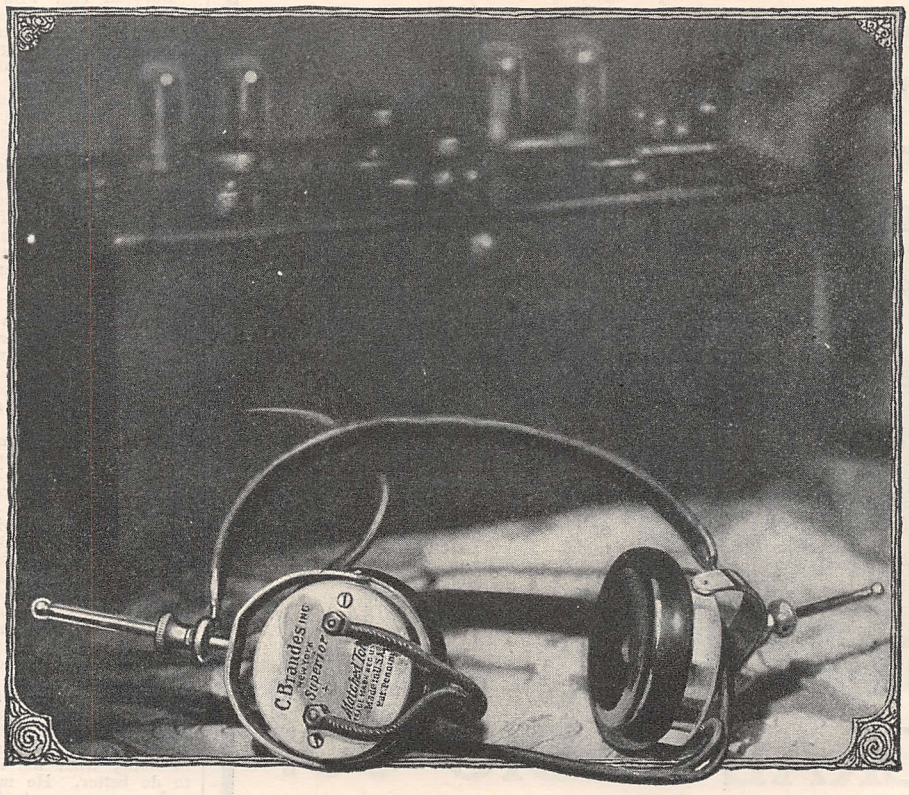
(*Continued from page* 1631)

much more easily read, possibly because they communicate by shouting over such long distances. In the "Peaks of Shala" will be found a very interesting account of this. Xenophon says in his Anabasis that a certain mountain tribe had their villages 12 miles apart because that was about the limit of distance for convenient communication by shouting. This seems incredible, but some men who have lived in mountain countries tell me it is possible. In any case it is evident that the language must be one in which the words are very sharply distinguished from one another, *i.e.*, the trains of sound waves, and, therefore, their tracings, are very distinctive. I have found this to be mainly due to the use of "explosive" consonants the shch, tsch, etc., of those eastern languages. Now there is no reason why we should not introduce those consonants into the English and other languages. The results would not be unpleasant, in fact I have found that the very best way to accomplish what voice trainers call "placing the voice," is to sing the group "Shchkyperi" (the native term for "Albanian") in place of the customary "May, me, mi."

(*To be continued*)

Fessenden and the Press

WHEN Professor Fessenden's first article appeared in RADIO NEWS in the January issue, it caused no little comment, both from our readers and the press. It seems that the whole world is waiting breathlessly for the distinguished inventor's autobiography, and we are certain that nothing like it has ever been published in radio literature up to now. We have received hundreds of commendatory



You *need* a headset

— to tune-in with

— to get distant stations — both domestic and foreign

— to listen-in without disturbing others

— to shut out the noise in the room — and get all the radio fun

— to get the truest and clearest reception — always

No one realizes these facts more forcibly than the makers of the famous Radiola IIIA. They include Brandes as standard equipment.

Brandes

The name to know in Radio

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Tune Out Interference

from conflicting stations. Use a GENERAL RADIO Filter

The Type 247-W Filter will tune OUT interference from stations you do not want. It will give you greater clarity of reception. Easy to attach — Easy to tune — Wavelength range 150 to 500 meters.

Price $10

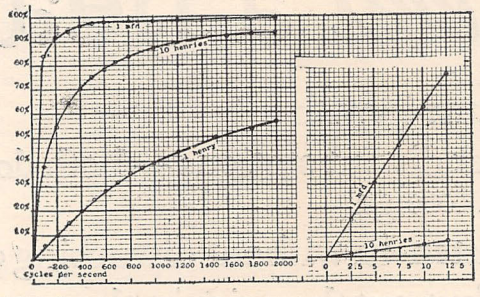
Sold by all Good Dealers.

Write for Descriptive Folder N.

GENERAL RADIO CO.

CAMBRIDGE, MASS.

No. 3 of a series of 10
"FILTER FACTS"
Follow them thru monthly



INDUCTANCE. Inductance in series with the plate supply suppresses a certain per cent of the a.c. component, dependent upon the frequency of the ripple and the value of the inductance. The curves show the per cent of suppression for a 1 henry and a 10 henry choke at common ripple frequencies for a small transmitting tube. For comparison the percentage of ripple by-passed by a 1 mfd. condenser as outlined in "No. 2," is plotted to the same scale. The insert curves are the 1 mfd. and 10 henry curves replotted to show their effects at the very low frequencies common to moving contact disturbances. Note the change in the shape of the curves as the inductance is increased, that the increase in suppression is not directly proportional to the value of "L" and that a small choke will be of little use especially at the lower frequencies.

The condenser curve should not be mistaken for a percentage reduction in ripple. It does not represent suppression, but by-pass. Reduction of the ripple thru the plate circuit takes place only when the current thru the condenser has become so large that it "breaks down" the ripple voltage. This action is dependent upon the design of the generator, and the load that it is operating under.

ESCO generators are so designed that their minute ripple is of as low amplitude and as high frequency as is practical.

ELECTRIC SPECIALTY COMPANY

TRADE "ESCO" MARK

211 SOUTH STREET STAMFORD, CONN., U. S. A.

IF INTERESTED IN MAXIMUM MILES PER WATT YOU WILL BE INTERESTED IN BULLETIN 237B

letters from readers all over the world, and as we go to press they are still coming in.

In the issue of Wednesday, December 10, the New York *Times* printed the following editorial:

INVENTORS AND CAPITALISTS

Between men with new ideas and men with money there has been from time out of mind a sort of war, the inventors charging that the capitalists ever are trying to get possession of the inventions for their exclusive financial exploitation, and to "freeze out" the discoverers and deprive them of either interest or power in the companies they form. The capitalists, on the other hand, insist that the inventors, as a class, are visionaries with whom it is difficult or impossible to do business as business ought to be done, and that after an invention is made its development necessarily must be in more practical hands.

A different view of this old controversy is presented in the current issue of RADIO NEWS, to which astonishingly large magazine Professor R. A. Fessenden, himself an inventor with a record of many and important achievements, including the heterodyne principle, is contributing an autobiography which promises to be of great interest. As a scientist, Dr. Fessenden naturally is fond of those large generalizations which have done so much for science and usually are called "laws." So he offers a new one, which deserves the attention of psychologists as well as of scientists. He thus formulates it:

"No organization engaged in any specific field of work ever invents any important development in that field, or adopts any important development in that field until forced to do so by outside competition."

That is a hard saying, and several of the great corporations that maintain staffs of eminent men to do research work are likely to question its accuracy. Dr. Fessenden, however, insists that he knows of no exception to his "law," and he presents a long and impressive list of notable inventions, none of which, he declares, was made by or for the companies which they might be expected most to interest, and in all of these cases, he further declares, the companies sneered at the inventions offered and refused to buy them, even at prices that now seem ridiculous. Therefore, says Dr. Fessenden, the last persons to whom an inventor should take his discovery are those engaged in doing what his invention would enable them to do better. He must go elsewhere for money and encouragement if he would avoid wasting his time.

SUCH ERRORS OFTEN EXPENSIVE

It is not at all difficult to understand why the man who goes to a great corporation, that has millions invested in a plant with which it is doing a successful and profitable business, gets but a cold welcome when he proposes what amounts to the scrapping of that plant and the entering upon a new and untried method of conducting its operations. But though, in such cases, refusals to buy or even to investigate are comprehensible, the long record of serious consequences following such refusals, as presented by Dr. Fessenden, shows plainly enough that with more wisdom the great corporations would have avoided the very costly mistakes which many of them have made as a result of their contentment with things as they were and their inability to see the compulsion to change soon to be exerted upon them. Change under compulsion is always expensive, for besides involving the hated scrapping of old machinery and the abandonment of old methods, it also involves the buying for a high price, from the inventor or his assigns, rights that once could have been obtained cheaply.

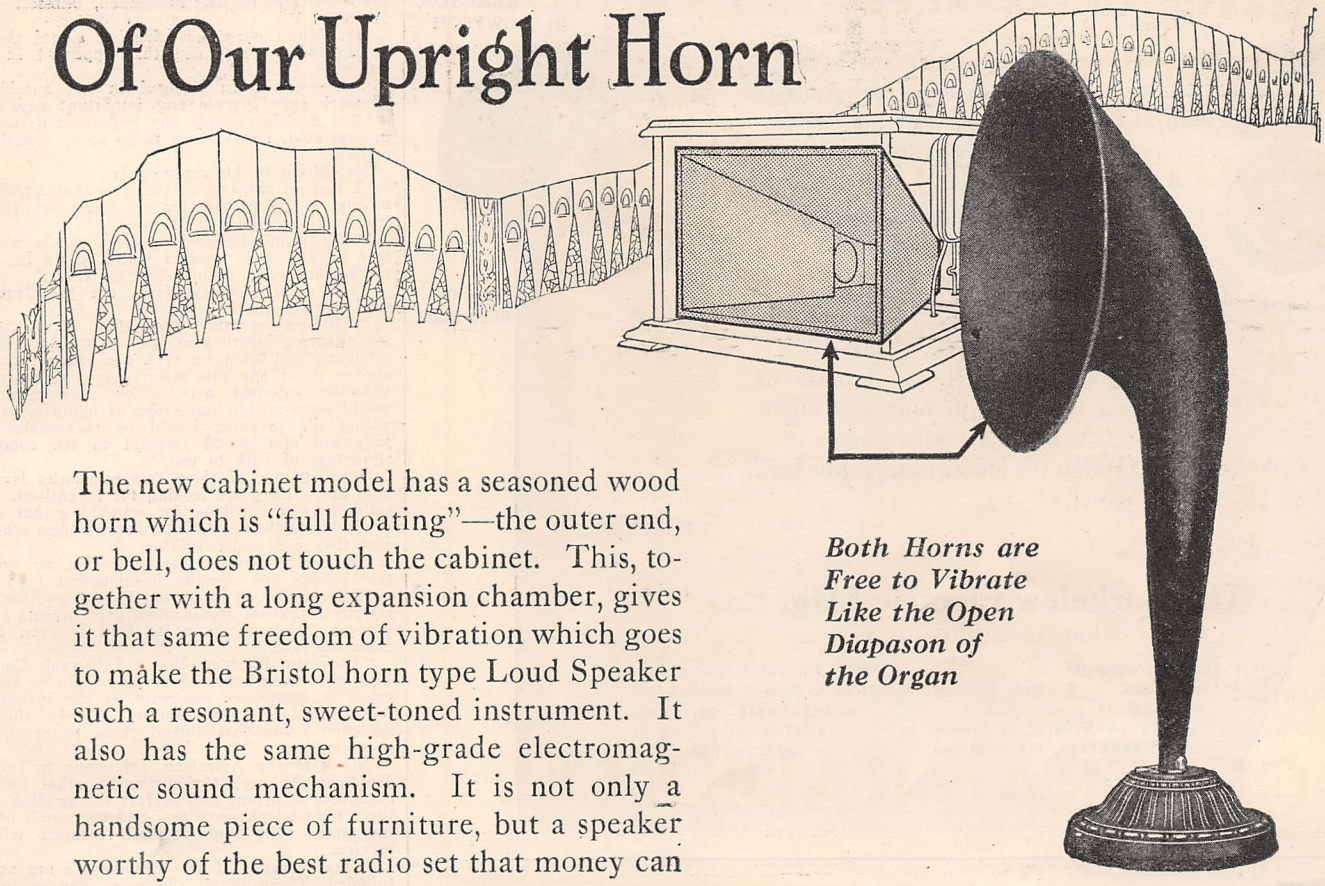
Dr. Fessenden tells the inventor not to go to the big fellows for help, but he does not reveal to whom appeal for recognition and financial help is more hopeful. The man who can be convinced that there are millions in a new idea rarely has the money required for backing that idea effectively. As a matter of fact, the would-be innovator never is liked by those who are doing well in the old, established ways. They resent his assumption of superiority—of his ability to teach them their business. Unless more than ordinarily open-minded and foresighted, they see only impudence in that, especially when it is done by a man who as yet has been successful only in dreams.

It was to be expected that this editorial would not go unchallenged. Indeed, a few days later the following article appeared in the New York *Times*, the statement having been given out by Orson D. Munn, of the *Scientific American*. When reading this article, it should be kept in mind that the publishers of *Scientific American* are also patent attorneys and, naturally, are interested in all patent phases. For this reason, their statement may be taken with a grain of salt. The article follows herewith:

SAYS INDUSTRIES HELP INVENTORS

Orson D. Munn, publisher of *The Scientific American*, recently issued a statement in which

It Has The Full Sweet Resonance Of Our Upright Horn

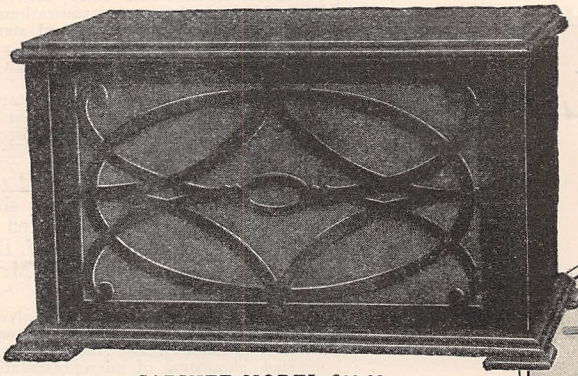


The new cabinet model has a seasoned wood horn which is "full floating"—the outer end, or bell, does not touch the cabinet. This, together with a long expansion chamber, gives it that same freedom of vibration which goes to make the Bristol horn type Loud Speaker such a resonant, sweet-toned instrument. It also has the same high-grade electromagnetic sound mechanism. It is not only a handsome piece of furniture, but a speaker worthy of the best radio set that money can buy.

Both Horns are Free to Vibrate Like the Open Diapason of the Organ

MODEL S
AUDIOPHONE
$25.00

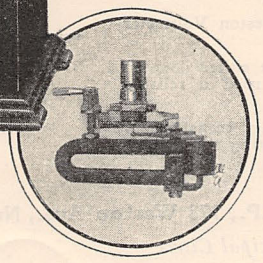
Rubber horn 14½" in diameter. Cast metal throat. Velvet mat finish of mottled bronze and gold.



CABINET MODEL $30.00

Beautifully finished mahogany. Full floating wooden horn and cast metal throat. Musically, a companion to the finest set ever built; size 17 x 10 x 10¼".

The "Voice" of the Audiophone



There are five Bristol Loud Speakers, priced from $12.50 to $30.00. If not at your dealers, write for Bulletin No. 3020-S.

Bristol TRADE MARK AUDIOPHONE REG U.S. PAT OFF Loud Speaker

The Bristol Company *Waterbury, Connecticut*

FOR 36 YEARS — Ask Any Technical Engineer — MAKERS OF

BRISTOL'S RECORDING INSTRUMENTS

BARKELEW

Attachments for Radiola III and III-A

ANTENNA
ANTENNA SELECTOR SWITCH

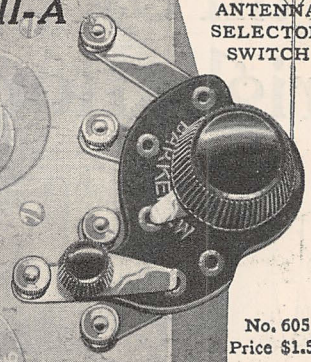
FOUR PHONE POST

No. 624
Price $1.00

Antenna Selector Switch

The full range of antenna adjustments can be made by simply turning the two knobs and without loosening a nut.

Remove the knurled nuts, slip the switch on the binding posts and replace the nuts. The antenna wire attaches to the one binding post on the rear.



No. 605
Price $1.50

Four Phone Post

This post will take any number of head sets from one to four and all in series. It is equipped with prongs that push through the phone holes in the face of the panel.

Radiola III

The Barkelew Electric Mfg. Co.
Middletown, Ohio. U. S. A.

NEW YORK, 157 Chambers St. — LOS ANGELES, 443 S. San Pedro St.
WASHINGTON, D. C., Mills Building — DENVER, Denham Building
CHICAGO, 15 Clinton St. S — MINNEAPOLIS, 1017 Lumber Exchange
SAN FRANCISCO, 75 Fremont St. — BOSTON, 31 Bedford St.
SEATTLE, 1014 Sixth Ave., S. — PITTSBURGH, Arrott Building

A Necessity:— NOT a Luxury

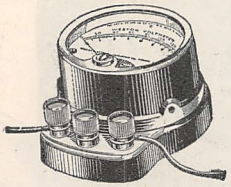
Every time you have had trouble with the operation of your set a Weston Voltmeter would have proven of great value.

Every time you wished to repeat tuning in a different station a Weston Voltmeter would have indicated whether your filaments were at the precise voltage you previously used.

Every time your "A" battery has been suspected a Weston Voltmeter would have indicated the true facts.

Every time you have replaced a "B" battery you have either done so too soon or too late, depending upon whether you used a reliable voltmeter.

Every time a circuit has opened whether in the wiring, transformers or elsewhere the quick and most dependable way of locating the "open" was by a continuity test with a dependable voltmeter.



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Electrical Indicating Instrument Authorities Since 1888

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Young Men—Turn Your Spare Hours Into Money!

Earn big profits, prizes, and awards selling RADIO NEWS, SCIENCE & INVENTION, THE EXPERIMENTER, and MOTOR CAMPER & TOURIST in your neighborhood. We train you as our salesman and pay you liberally for your time. Write at once and we will help you to get started.

M. BRIDWELL

THE EXPERIMENTER PUBLISHING CO., 53 Park Place, New York, N. Y.

he warned that unless something was done quickly to squelch the widespread, though unorganized, campaign of misrepresentation emanating even from certain distinguished scientists, inventive genius may be stifled. Mr. Munn takes exception particularly to the charge that American industry develops no important invention until compelled to do so by competition. His statement is in answer to Professor R. A. Fessenden, himself an inventor.

Mr. Munn cites the following signed statement by Professor Fessenden that appeared in RADIO NEWS:

"No organization engaged in any specific field of work ever invents any important development in that field, or adopts any important development in that field, until forced to do so by outside competition."

Mr. Munn in his reply said:

"I had on my desk at the time that article came to my attention two letters. One was from an iron works president. It says:

"'We would be glad to consider the manufacture of any new product which could be readily marketed to our regular line of trade.'

"The other letter is from the president of a steel company. He says:

"'Of our monthly production of 7,000 tons, less than one-fourth goes into what we call finished products, and what we seek are avenues that will absorb all of our raw materials. There are many valuable patented articles or inventions which would come within our scope of manufacture, providing the inventor would be reasonable in his judgment and would respond to the commercial advantage of both to us.'"

"The attitude of these two companies is a common one. They are looking for inventions. Naturally, they are looking for something that will be profitable to them. No one would expect otherwise. But they are really looking.

"So much for the statement that no organization adopts any specific development in its field until forced to do so by outside competition. The statement that no organization ever invents any important development in its field is even further from the facts.

"Take the Western Union Telegraph Company. Multiplex telegraphy, or sending eight or ten messages at once over one wire, is the invention of the men of that organization. Surely, there was no competition that forced them to develop this invention.

"Look at the American Telephone & Telegraph Company. Where's the competition that forced its engineers to invent and perfect the sending of pictures over telephone wires, and thousands of other inventions that improve and cheapen telephone service.

"These charges of Dr. Fessenden's are not well founded. There is all the more danger in them because they come from so distinguished a source. Men invent things not from altruistic motives, for the most part, but because they hope to make a profit for themselves. Once convince them that large American business organizations will not have anything to do with the forward steps that American genius points out in industry, and the motive for inventing is taken away. Men will cease to be inventors.

"The time has come to put a stop to these pessimistic statements for two reasons: First, because they are dangerous and second, because they are not true."

Dr. Fessenden was apprised of the situation at once, and he made the following answer, which was also printed in the New York *Times* in their issue of December 27. Dr. Fessenden replied to Mr. Munn as follows:

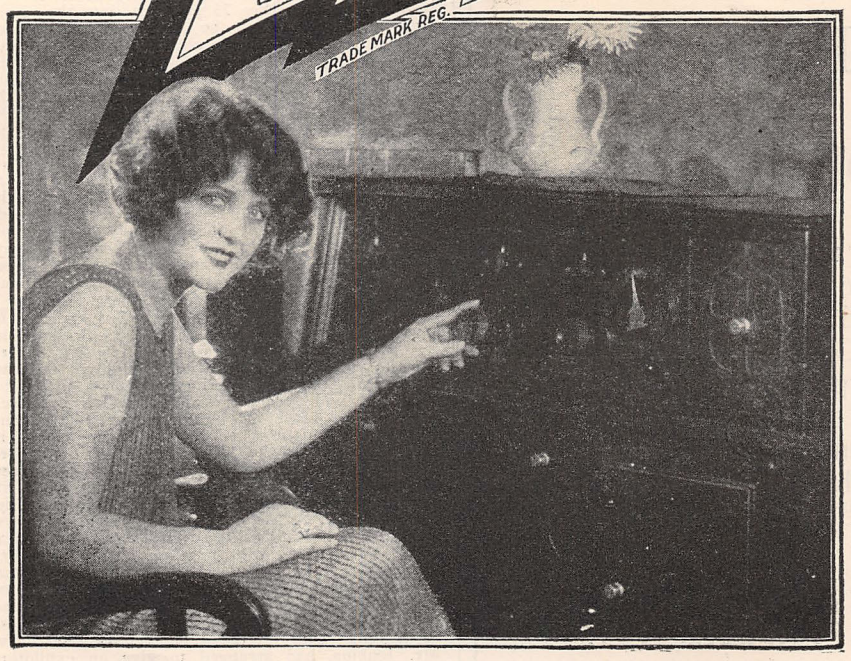
The *Scientific American* has given out to the press an article, urging that "something be done quickly to squelch the widespread, though unorganized campaign of misrepresentation emanating even from certain distinguished scientists" in regard to "analysis of economic tendencies and gloomy pictures of the selfishness of corporations"; the correct information being, apparently, that corporations are altruistic and that economic tendencies should not be analyzed.

Mr. Orson D. Munn admits that the movement is widespread, spontaneous, and endorsed by eminent students of such matters, but he has apparently not realized the nature of the phenomena which have so discouraged inventors. The movement he is attacking is one undertaken for the specific and stated purpose of *helping* inventors, and incidentally it will help Mr. Munn. The movement he *should* attack is not the widespread, spontaneous movement by those who see that invention is being crushed out in the United States and are trying to preserve it, but the narrow-minded, short-sighted, carefully planned and propagandized movement of a few of our large corporations, now trying to put through in Washington legislation which will practically annul the patent laws of the United States except so far as they will enable them to monopolize industry, and which will eliminate entirely the individual inventor (and incidentally eliminate Mr. Munn's business except so far as he can associate himself with, and be at the mercy of some corporation or corporations).

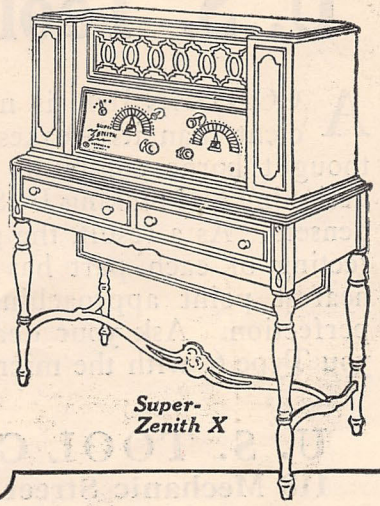
The particular statements which Mr. Munn objects to are two made by me in the January number of RADIO NEWS; *i.e.*, that—

ZENITH RADIO

They Cost More But They Do More



Super-Zenith VIII— the ideal radio set for the fine home



Super-Zenith X

To choose at will one glorious voice— one majestic symphony

A few blocks from your home a powerful station may be on the air. Other locals—six, eight or ten of them—may be broadcasting at the same time.

Imagine, now, the satisfaction of tuning them all out and bringing in distant cities. The air a chaos of sounds, yet out of that chaos, from across the continent, one glorious voice, one majestic symphony—the very program that you wanted most to hear—and as clear and appealing as though it were in the next room.

The ability to take your choice—that is what you want above all else in radio reception. And it is that very property, built into the Zenith, which makes it supreme among fine radio sets. The joy of possessing such an instrument is all the greater from the fact that its beauty of design and excellence of construction speak quietly of its distinction.

Before you choose the receiving set to occupy the place of honor in your home, be sure to see and try the Zenith. Its beauty you will recognize at a glance. Its extraordinary capabilities any Zenith dealer will be glad to demonstrate.

Dealers and Jobbers:
Write or wire for our exclusive territorial franchise.

ZENITH RADIO CORPORATION

332 South Michigan Avenue, Chicago

ZENITH—the exclusive choice of MacMillan for his North Pole Expedition

The complete Zenith line ranges in price from $95 to $550.

With either Zenith 3R or Zenith 4R, satisfactory reception over distances of 2,000 to 3,000 miles is readily accomplished, ***using any ordinary loud speaker.*** Models 3R and 4R licensed under Armstrong U. S. Pat. No. 1,113,149. They are NON-RADIATING.

Zenith 4R - - $95
Zenith 3R - - $160

The new Super-Zenith is a six-tube set with a new, unique, and really different patented circuit, controlled exclusively by the Zenith Radio Corporation. It is NOT regenerative.

SUPER-ZENITH VII—Six tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44⅞ inches long, 16¾ inches wide, 10⅝ inches high. Compartments at either end for dry batteries. Price (exclusive of tubes and batteries) $230

SUPER-ZENITH VIII—Same as VII except—console type. Price (exclusive of tubes and batteries) $250

SUPER-ZENITH IX—Console model with additional compartments containing built-in Zenith loud speaker and generous storage battery space. Price (exclusive of tubes and batteries) $350

SUPER-ZENITH X—Contains two new features superseding all receivers. 1st—Built-in, patented, Super-Zenith Duo-Loud Speakers (harmonically synchronized ***twin*** speakers and horns), designed to reproduce both high and low pitch tones otherwise impossible with single-unit speakers. 2nd—Zenith Battery Eliminator, distinctly a Zenith achievement. Requires no A or B batteries. Price (exclusive of tubes) $550

Price (without battery eliminator) $450

All Prices F. O. B. Factory.

ZENITH RADIO CORPORATION, Dept. B-3
332 South Michigan Avenue, Chicago, Ill.

Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

Name.....

Address.....

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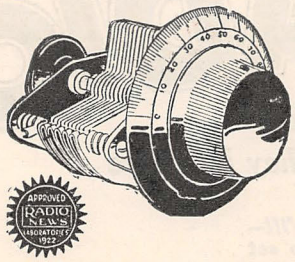
Q-U-A-L-I-T-Y



Based on Perfection of Parts in

U. S. Tool Condensers

A CONDENSER is no more efficient than its weakest feature—a thought borne constantly in mind in designing and making U. S. Tool Condensers. As a result, the gradual perfecting of each part has lead to the nearest point approaching condenser perfection. Ask your dealer to show you Type 6, with the micrometer dial.

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Write for Literature

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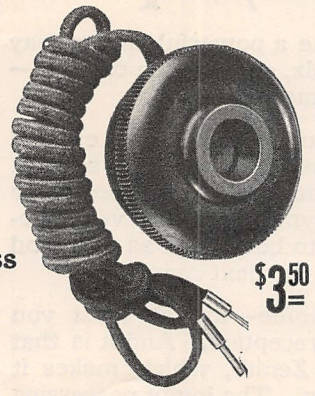
Mfrs. of Special Tools, Dies, Jigs, Automatic Machinery and Sub Presses

PEERLESS

$8.50

If you know the quality of our Peerless Headphones, all we need to say about the Peerless Quality Loud Speaker and Peerless Quality Phono Unit is that they are



$3.50

Built Up to the Peerless Standard of Quality— Not down to a price

JOBBERS, DEALERS, Write for samples and discounts.

UNITED RADIO CORPN.
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PEERLESS Phonograph Unit

For Victor and Sonora. Just right for mfrs. of sets using built-in speakers.

CRESCENT LAVITE RESISTANCES

12,000 / 48,000 / 50,000 / 100,000 Ohms — List $1.50

Special Sizes to Order at $2.50 each

When better resistances are made they will bear the Crescent label. Dealers write for discount.

CRESCENT RADIO SUPPLY CO.
1-5 Liberty St. Jamaica, N. Y.

5000 RADIO DEALERS buy from HUDSON-ROSS
123 W. Madison St. Chicago
Send for dealers discount.

"No organization engaged in any specific field of work ever invents any important development in that field; or adopts any important development in that field until forced to do so by outside competition."

Mr. Munn states that the latter is not true, because he had on his desk at the time that article came to his attention two letters containing inquiries from manufacturers. Surely, this is an inadequate reply, is not one specific instance worth two letters of inquiry on the desk, and I gave a scorce of instances, beginning with the cable and the telephone and ending with the turbo-driven battleship and artificial silk. And one of the letters was from a man who states that only 25 per cent. of his production is finished product. Was he inquiring under stress of competition or was he dumping the other 75 per cent. into the river? Mr. Munn's answer to the other statement is even more unfortunate, for he gives as his two selected instances the multiplex telegraph and the radio pictures. The first has been a standing joke among inventors. The method was published in the *Electrical World*, for example, September, 1894. Over 100 demonstrations have been given, by too sanguine inventors, to the telegraph and cable companies since that time. Its use was urged on the cable and telegraph companies just prior to the war. The story is too long, but in brief the companies Mr. Munn credits had nothing to do with the development. They simply looked over all the systems sent in, and then when the patents had run out and there seemed to be some danger from radio competition, they used them, without paying the inventors a cent.

As regards Mr. Munn's second instance, the sending of pictures over telegraph wires, if he will look in the back pages of the *Scientific American*, he will find at least a dozen different systems, *all of which worked*. If he goes up to the Hotel Astor he will see Gray's form, which has been used in the hotel for 20 years for transmitting writing and pictures between different offices in the hotel, and in the back numbers of his paper accounts of its use in sending pictures between Boston and New York. He will also find an account of the tendering of the radio picture device to the U. S. Navy, and the subsequent events, in 1920, in a book called, "The Deluged Civilization" (which he will find in the New York Library). Put briefly, what happened was that the inventors of radio pictures showed signs of getting outside capital and the corporations decided at a meeting in January, 1922, to try and cut them out. One of the inventors, a good man, Mr. Jenkins, had arranged to give an exhibition between Boston and Washington. When this was announced the corporations rigged up some apparatus to try and get ahead of Mr. Jenkins. Their apparatus took about 20 minutes to transmit a coarsely grained picture, as anyone can see for himself by inspecting the pictures received; as against perfect definition and five pictures per second guaranteed four years before by some of the inventors. But they rushed it through so as to be ahead of Mr. Jenkins, and when Mr. Jenkins came to make his test, he found the air full of so much interference that he did not succeed until after trying several days. And the amusing part is that the great improvement which the corporations stated was "the keystone of the system" turned out to be the use by the corporations of a device which had been offered to the corporations four years before and which they had copied; and they were promptly served with notice by the inventor that they must stop using it.

I regret to disillusion, Mr. Munn, but the articles referred to by him were written solely in the interest of inventors and to make them understand that the large corporations never buy from inventors, but merely look the inventions over with a view to dodging them, or else wait till they are run out. If Mr. Munn will continue to read the articles appearing in RADIO NEWS, he will learn of the means which the history of inventions has shown to be the best means for the inventor to adopt, and which will incidentally be of much benefit to the members of the Patent Bar.

The New York *Times* again commented editorially on this phase in their issue of December 29, as follows:

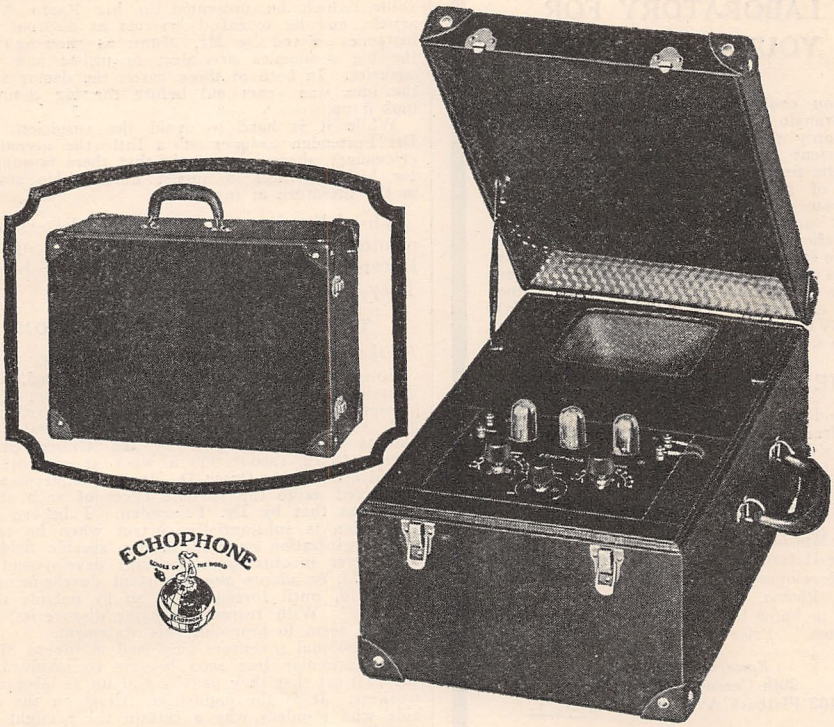
LET'S HEAR FROM THE COMPANIES

As was to be expected, a controversy that promises to be a lively one has been started by the statement in the magazine RADIO NEWS by Professor Reginald A. Fessenden that the very last and least hopeful place for an inventor to take his new idea is to one of the great companies which are exploiting the field to which the new idea belongs. And Dr. Fessenden further declared that never, except after long delay, and then under the pressure of outside competition, had any such company given any encouragement or aid to an inventor whose discovery or plan or process, if adopted, would necessitate the abandonment of established methods and machinery.

These assertions, as viewed by Orson D. Munn, the publisher of the *Scientific American*, required that something be done to end "the widespread though unorganized campaign of misinformation emanating even from certain distinguished scientists," as otherwise inventive genius in America will be stifled.

As just such stifling was what Dr. Fessenden charged against the big companies, and just what he bitterly complained of, it seems a bit strange

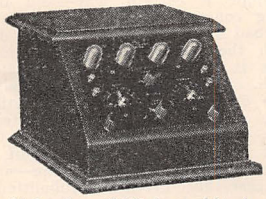
Introducing the ECHOPHONE *Portable*



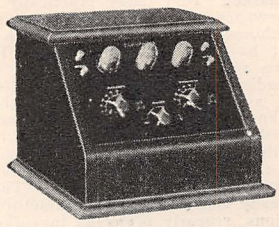
Compact—
Light in Weight
Yet No Sacrifice
in VOLUME

$75.00

Without Tubes and Batteries



The Echophone "4." A combined radio frequency four tube receiver of unusual selectivity. Two tuning dials with special adjustment for volume. May be carefully calibrated for logging new stations. Non-radiating—clear-toned, easy tuning. Without Tubes and Batteries **$75**



The Echophone "3" an exceptionally powerful 3-tube set. Uses dry batteries. Two dial tuning. Range 1800 to 2000 miles. Without Tubes and Batteries **$50**

Here is the ideal portable receiving set—a musical instrument you can enjoy every night of the year—at home or wherever you happen to be.

Weighs only 32 pounds. Takes up no more room than an ordinary traveling bag—size 9″ x 12½″ x 18″. As it uses a standard 60 foot stranded wire aerial which may be quickly hung around the picture molding or thrown over the branches of a nearby tree when the set is operated in camp there is not the sacrifice in efficiency usually found in portable receivers. For carrying purposes the aerial automatically winds on a spring reel fitted in a special compartment of the case.

The rich tones of the Echophone receiving unit are guided by the built-in loud speaker up against the raised lid of the carrying case and deflected into the air with the same softness and mellowness they had when they entered the microphone.

Finished in handsome DuPont Leather, the Echophone Portable is in keeping with the finest living room appointments; yet it has ample strength for severe vacation service. And the additional cost over that of the cabinet type is no more than the price of a good loud speaker! Available with Echophone "3" receiving unit—$75.00, with Echophone "4" unit $98.00. Those who already have either of the Echophone cabinet receivers, may secure the case complete for $30.00.

Ask your dealer to show you this set. In the meantime send coupon below for descriptive folder.

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1120 North Ashland Avenue, Chicago, Illinois

Echophone Radio Shop
Long Beach, Calif.

Echophone Sales Co.
156 2nd St., San Francisco, Calif.

ECHOPHONE

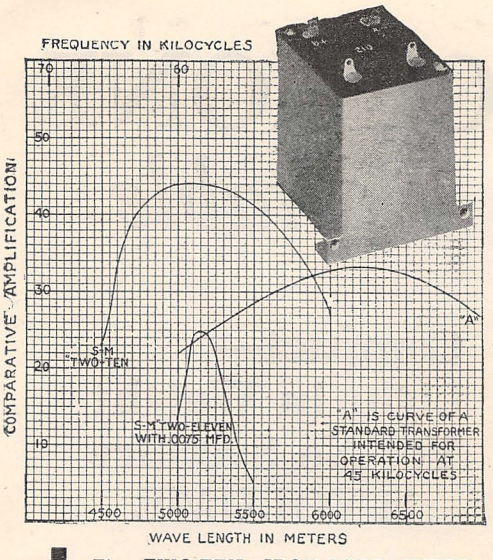
Storage Battery Results at Dry Cell Cost

ECHOPHONE RADIO, Inc.
1120 North Ashland Ave., Chicago, Ill.
Please send me folder describing fully the Echophone Portable and the Echophone "3" and "4"
My Radio dealer is:

.....

My Name .....

My Address .....



CURVES

PLOTTED IN OUR LABORATORY FOR YOUR PROTECTION

If you could have a laboratory measure the transformers for your super, you would use only the best—proven by test. The inefficient ones would be rejected. Now, for the first time, you can have the benefits of laboratory measurements. Our laboratory plots the curve of each TWO-TEN and TWO-ELEVEN Long Wave Transformer. It goes on the tag attached to the instrument. It shows the peak, sidebands passed, amplification expected. There is no guesswork. You build your super with assurance. TWO-TENS and TWO-ELEVENS cannot be equalled for interstage use in any super.

The TWO-TEN—IRON-CORE INTERMEDIATE TRANSFORMER. Passes 11 kilocycle sideband without distortion. Peak 5,000 meters. Provides 1½ to 2½ times amplification obtainable with any other transformer.

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Both types in individual aluminum cases. Suitable with any tube in from one to four stages. Supplied in sets of two, or three TWO-TENS, and one TWO-ELEVEN, each with identical peaks and separate curves.

Price of either transformer, each....$8.00
Circulars sent upon request.

THE WHY OF SILVER SUPERS

Send for the "Why of Silver Supers." It's free. It tells the story behind the Super that gives coast to coast reception on a loop with loud speaker volume.

THE PORTABLE SUPER

McMurdo Silver's book, "The Portable Super-Heterodyne," is a detailed account of the development of the Seven-tube Wonder Set. Photos, diagrams, drawings—all you need to know to build the "Electrical Masterpiece." Price 50c.

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102 Flatbush Ave., Brooklyn, N. Y.

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New KIC-O "B" Battery and Double Potenial Charger

PRICES

PZ indicates panel type with switches. CZ is plain type without switches.

Voltage	M.A.H.	Type PZ	Type CZ
130	2500	$36.00	$33.00
100	2500	27.50	24.50
70	2500	21.50	18.50
45	2500	16.00	14.50
22½	2500		7.50

KIC-O Chargers

Type K-1 Single unmounted	$1.50
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Type K-3 Multi-Polar mounted.	5.00
KIC-O Special Charger Chemicals (one cell)	.50

Let KIC-O Batteries Help You to Get Those Far-away Stations

APPROVED RADIO NEWS LABORATORIES 1922

The real thrill for a true radio fan comes when he tunes in on a new station further away than any he has ever heard before. That is one of the reasons why we are continually receiving hundreds of letters of high praise for KIC-O Storage "B" Batteries. Each letter proves more conclusively the unrivaled superiority of the KIC-O for better, clearer, truer, radio reception.

Nickel-zinc construction of KIC-O elements preserved by a special alkaline solution give KIC-O Batteries practically unlimited life. They give an even, dependable discharge over long periods of service and are not harmed by idleness or overcharging.

And with the KIC-O single or double potential charger which charges the battery from any 110 volt A.C. lighting line, you will have a real permanent power plant which will last for years.

All KIC-O products are backed by a satisfaction or money back guarantee.

Ask your dealer or write for full information today.

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Please send items checked below to undersigned address:

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Voltage..... Price.....
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Full information regarding KIC-O equipment.
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that he should be accused of doing what he said those whom he criticized were doing. He seems not to have been mollified by the *Scientific American's* implication that he is a distinguished scientist.

However that may be, he returns to the battle by calling renewed attention to the long list of rejected inventions, afterward proved of great value, which he presented in his RADIO NEWS article, and he scornfully rejects as disproof two instances offered by Mr. Munn as showing that the big companies are alert to utilize new discoveries. In both of those cases, the doctor says, the idea was years old before the big company took it up.

While it is hard to avoid the suspicion that Dr. Fessenden exaggerated a little the inventor's grievances, there is no doubt that there is support for his assertions in almost innumerable stories in the literature of invention.

The following are two further letters also printed in the New York *Times*, issue of December 28, bearing on the same problems. They make good reading:

THE HARDSHIPS OF INVENTION

To the Editor of The New York Times:

Since the dawn of civilization, initiated, incidentally, by inventive genius, inventors have labored on in the face of all kinds of hardships, and, considering the ever increasing number of patents issued each year by the United States Patent Office (about 900 a week at present), it would appear that Orson D. Munn is unnecessarily concerned as to the possible effect of such statements as that by Dr. Fessenden. I believe Dr. Fessenden is substantially correct when he says: "No organization engaged in any specific field of work ever invents any important development in that field, or adopts any important development in that field, until forced to do so by outside competition." With respect to major discoveries, the records seem to bear out this statement.

Professional inventors employed to invent along some particular line soon become so involved in the past art that they usually end up as laboratory workers. It is the inquisitive fellow on the outside who wonders why a certain thing might not be done a certain way—and does it. As to a big concern taking up new inventions, that is a broad subject. Very seldom does the outsider reach the right man with his idea. Very often there is no particular disinterested individual to reach. The proposition is usually handed down from one official to another until it gets to the head of the department devoted to inventions work—and if it should happen that that department has been spending a lot of money trying to do substantially the same thing—and if, as is often the case, the invention submitted is in a crude state, it stands to reason the inventor is going to get some opposition. Then there is the question of policy.

A few years ago there was no small practical portable typewriter on the market. The big concerns were not interested in the subject. An independent concern successfully marketed such a product—did the necessary pioneer work—created a market. And today practically all of the other typewriter manufacturers have introduced small machines and are trying to break into the market that has been shown to exist. The big concerns were making money while the other outfit was spending it—that is business policy.

I am sufficiently in touch with inventive work to know that there are many concerns looking for worthwhile inventions, but this does not necessarily disprove what Dr. Fessenden says. Nor do the extracts from two letters from manufacturers, quoted by Mr. Munn. There is, I believe, a ready market among manufacturers for any meritorious, properly protected invention that is offered on a fair business basis. The average manufacturer is not looking for epoch-making discoveries as a rule. He may wish to add a few new products to his line. Hundreds of suitable things are patented each year, but unfortunately most patents are worthless. They do not protect the invention, and this is one of the chief reasons why so many inventors are turned down. The inventor may have a good idea, but if he is not competent fully to disclose it to his attorney, or if his attorney is not capable of drawing out the information from his client, the patent, when it is issued, will probably be of little value. The work of a patent attorney is very exacting and calls for exceptional skill and broad experience. The inexperienced inventor will not pay for such work. Why should he when so many attorneys advertise cheap rates? But he learns in time, after it is too late.

Inventive genius cannot be stifled, but the path of the inventor might be made easier.

EDWARD F. CHANDLER.

New York, December 23, 1924.

PROBLEMS OF THE INVENTOR

To the Editor of The New York Times:

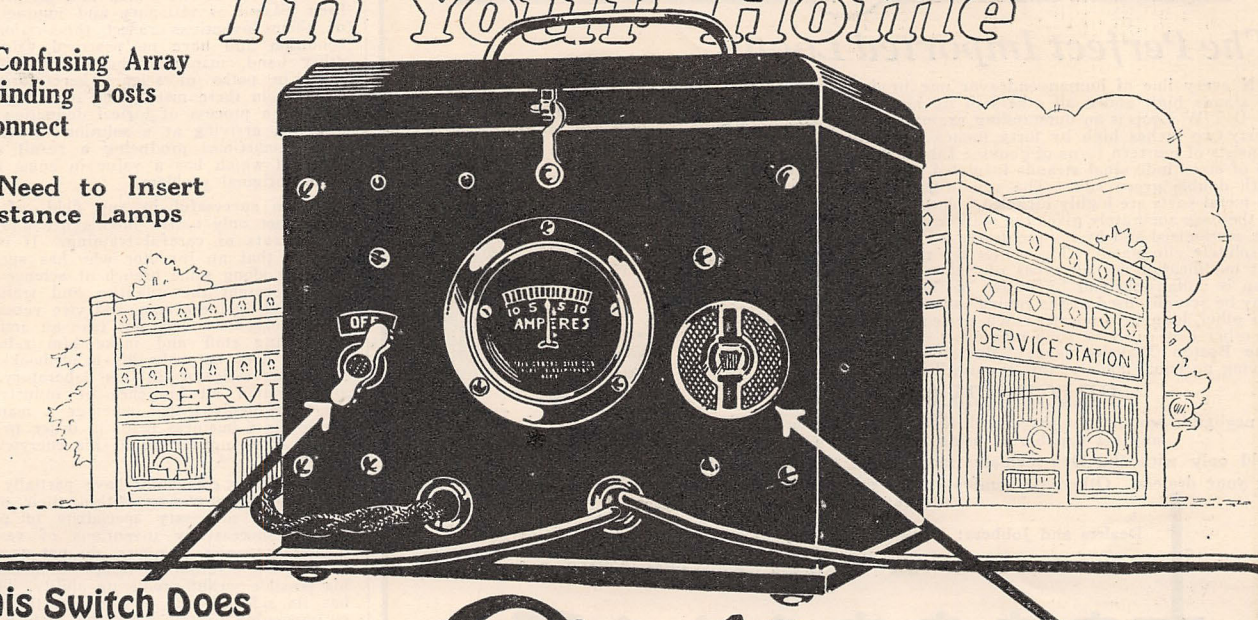
There appeared today under a heading, "Topics of the Times" an article with a subtitle, "Inventors and Capitalists," which was of great interest to me personally.

As a consulting engineer, I have spent most of my life assisting inventors and working with them, and I have found the situation to be sub-

The Little Service Station In Your Home

No Confusing Array of Binding Posts to Connect

No Need to Insert Resistance Lamps



This Switch Does It All

For 6 volt "A" Batteries

For 24 volt "B" Batteries

For 48-72 volt "B" Batteries

Sterling RECTIFIER

Plug for "B" Battery Attachment

Charges "A" or "B" Batteries from a Single Unit

EACH quarter turn of the selector switch automatically adjusts this rectifier for charging 6 volt "A," 24, 48 or 72 volt "B" or two sections of 48 volt "B" Batteries.

No expensive bulbs to replace. No metal contacts to fuse or burn out.

No chemicals or liquid to replace. No special care or wear.

Adequate charging rate. Battery fully charged over night. Charging rate *not merely claimed* but *actually shown* by accurate ammeter on face of charger.

The Sterling Battery Charger charges "A" Batteries at 5 amperes. Start the charger in the morning and the battery is ready when you come home at night. It is very quiet in operation, the only sound produced being a faint, drowsy hum. But it is not merely quiet, it recharges a battery within a reasonable length of time.

Not a new product or experiment but a real tried and true charger with a five year reputation behind it THAT IT IS JUST AS EASY TO USE AS AN ELECTRIC IRON.

With proper use it will give excellent service for years.

Model 19

(for "A" and "B" Batteries)
$22.50 (50 or 60 cycle)
$25.00 (25 cycle)

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(for "A" and automobile batteries only)
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Both housed in a beautiful metal case

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Send for free booklet containing description of all Sterling Radio Equipment and diagrams, hook-ups and log sheets.

STERLING POCKET METERS TO TEST YOUR BATTERIES

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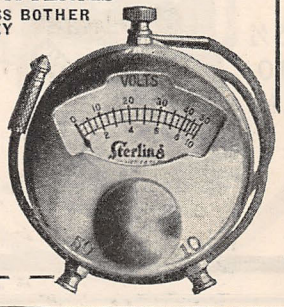
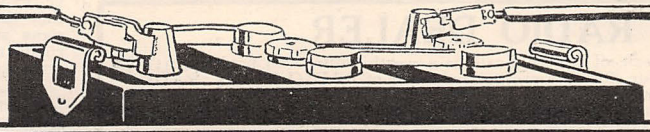
These meters are accurate, dependable and have the "right resistance."

No. 36. An ideal combination voltmeter with double scale, one for 0-10 volts for "A" Battery testing and other for 0-50 volts for "B" Battery testing. **PRICE — $3.50**

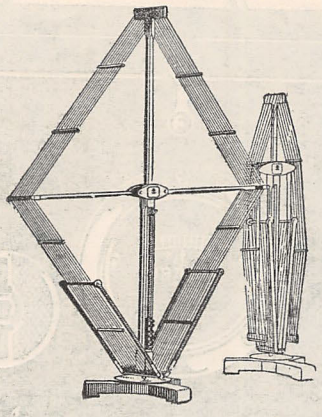
No. 35 for "B" battery testing. 0-120 volt scale. **PRICE — $3.50**





TOBE C.
DEUTSCHMANN
Fine Radio Apparatus

The Perfect Imported Loop



IN every line of human endeavor one product invariably stands high above all others of its kind—In Radio the D T W Loop is an outstanding example of this fact.
Forty-two inches high by forty inches wide, its inductance consists of fourteen turns of genuine Litzendraht cable, made up of sixty individual strands insulated twisted and covered with double green silk. The woodwork is mahogany and all metal parts are highly nickeled. A graduated metal table at the base accurately gives the station direction. The turns are sectionized and by unique design all "dead end" effect is absolutely eliminated. The center tap permits its use without modification for all types of Super Heterodynes. The loop is collapsible and by means of the adjustable slide it may be actually used as the tuning unit of the set.
No other loop incorporates such perfection of design, and no other loop can give such marvelous results.
The Boston Traveler says: "Masterpiece in construction having no equal made in this country."

PRICE $25.00

A negligible amount compared with the results it renders on any set capable of using a loop.
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Dealers and Jobbers: Write or wire for our exclusive territorial franchise.

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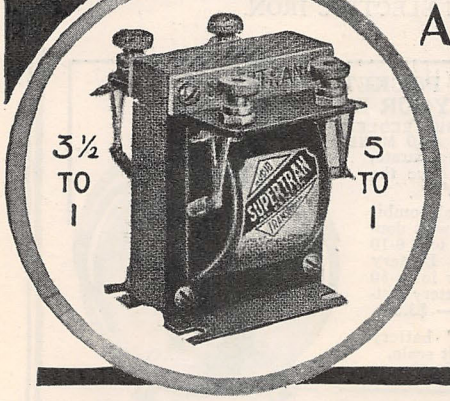

When your set is equipped with Supertran audio transformers you are assured faithfulness in reproduction, clarity, and freedom from all distortion. The Supertran being shielded, is protected against damage to the coil while mounting.

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TO THE RADIO DEALER

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stantially as set forth in your write-up. I think, however, that I can throw some additional light on the subject not only from the psychological standpoint but in providing a possible solution to some or all of the difficulties encountered.

Inventors may be classified into two groups: Those who invent through sheer mental brilliance and those who arrive at a solution through painstaking research work. The first group resemble artists in their mental processes and are rarely capable of becoming successful business associates. It is because of these men that all inventors have been classed as visionary and impractical. Many of their inventions reflect this visionary mental condition and have no practical value. On the other hand, many of the really brilliant inventions in paths of science heretofore untraveled come from these men. The second group invents through a process of logical deduction and experimenting, arriving at a solution by much detailed work, sometimes producing a result entirely unexpected which has a value in some field foreign to the original problem.

To be successful in any field, of course, requires not only native intelligence and ability but many years of careful training. It is, therefore, obvious that an inventor who has spent his time thinking along some branch of science cannot possess overnight the qualities and training of the successful business man, and vice versa. The successful organizer does not take an artist from his advertising staff and make him sales manager. Neither does he make his head bookkeeper a research investigator in his laboratory. Through specialization all branches of industry have become so involved that whether a man be an inventor or a business man, in order to be successful he must muster all of his energies to his selected field.

Some large companies have partially solved this difficulty by providing within their organizations all of the necessary specialists to produce and market successfully inventions of various kinds. These companies, however, do not as a rule care to pay an inventor a salary commensurate with his possible wealth-producing ability. The company has its side of this question in the fact that it is impossible to tell what the man will produce. He may give birth to an idea worth millions or he may spend his life in the laboratory earning nothing for the organization. Often an inventor will produce only one invention in his life that is successful commercially. He feels, therefore, when he has produced an invention that is practical and for which there can be created a demand that he has his chance to become financially independent. He is thoroughly convinced of the importance of his invention and is often confident of his own ability as a business man. He is inclined to minimize the importance of having associates who are trained in business practice to help on that end of the work. The result is that many companies are formed to market an invention, and many such companys fail through lack of knowledge on the part of the organizers and managers.

The successful business man is just as essential to success as is the invention. He must bring to the organization not only his ability, but he must gamble a considerable amount of money in addition. He, and not the inventor, must control the company, because it is his judgment which must solve the financing, manufacturing and marketing problems.

After many years of study of this problem, the following possible solution to the difficulty has presented itself to me. It is, I believe, based on sound business laws and principles, while at the same time offering to inventors a solution to their financial troubles by first enabling them to perfect their invention and then placing the invention in its true economic position, giving to the inventor his just share of the proceeds of his invention and protecting him from himself as well as from the unscrupulous exploiter of inventors.

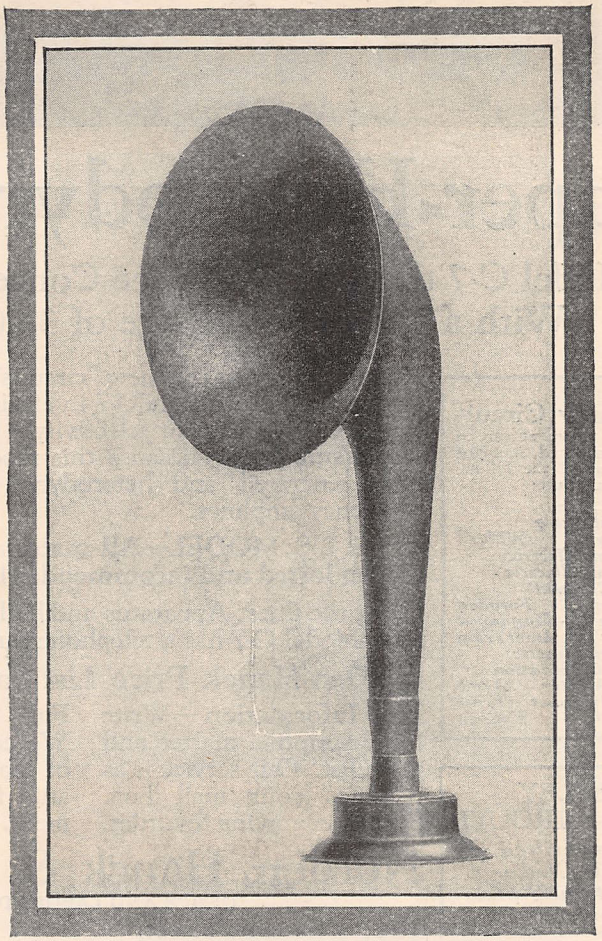
The proposal includes the establishment of a complete industrial laboratory divided into the various departments of science. At the head of each department will be a man of mature experience and thorough training, who will be assisted in a consulting capacity by a group of outside specialists in the branches of industry covered by his department. Into this laboratory will be admitted inventors who possess an undeveloped idea. They will first submit the patent for consideration to the technical heads of the laboratories, who shall render a decision on its technical feasibility. It shall then be passed upon by a group of business men, who shall judge of its commercial possibilities. If both groups pass favorably on the invention and the patent is valid, the inventor enters the laboratory, and with the assistance and co-operation of the head of the department, together with such outside consulting advice as may be expedient, works out the invention. At the time the inventor is admitted to the laboratory, he signs an agreement assigning 51 per cent. of his rights to the laboratory. He also receives a moderate salary while working out his invention.

When completed the invention is turned over to the business organization and a decision reached as to the best means of marketing the invention, whether by sale, license or manufacturing and distributing through subsidiary corporations.

ROLAND B. DAY.

New York, December 12, 1924.

You can't get more at ANY price!



1 Exceptional, natural, tone-quality that enables you to get the full musical values of the very low as well as the high tones

2 Satisfying volume that floods the room and allows everyone to enjoy the program

3 Fine appearance to harmonize with the refinements of your set and your home

4 100% value—$10

The Manhattan Junior $10

has all these features—and, in addition,

—it has the famous "Concert Modulator"! By means of this adjustment the Manhattan Junior can be accommodated to the tubes and the strength of the "B" battery of your set. Under all operating conditions this loud speaker will always give the best results. Visit your nearest dealer and ask to hear the Manhattan Junior. Like thousands of other radio enthusiasts, you will marvel at its beautiful tone-recreation—And only ten dollars!

RED SEAL
the comfortable *headset*

No longer need you use a headset that clamps tightly against your ears or that furrows your skull. The light pressure of the RED SEAL with its soft, moulded-rubber band and comfortable bakelite caps makes hunting DX stations a pleasure instead of a headache.

Ask for a RED SEAL
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Made by
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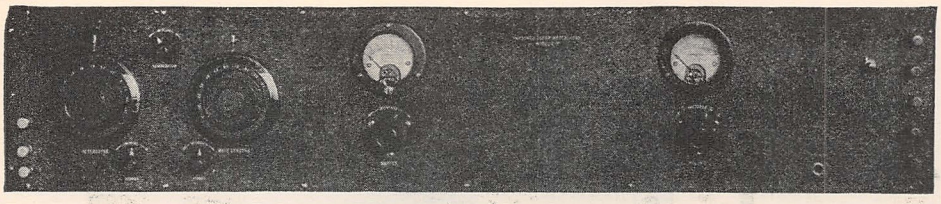
MADE BY THE MAKERS OF THE FAMOUS RED SEAL DRY BATTERIES



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Model C-7 the Long Distance Concert Receiver With a Telephone Range of 3,000 Miles

For any Circuit
Prompt shipment can be made on tested, standard apparatus of the following manufacture:
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PRESSLEY CIRCUIT
as described in Popular Radio. We furnish parts as specified.

None of the so-called new "circuits" or modifications of standards approach the C-7 in efficiency—for long range, for high audibility, for selectivity. ***Seven tubes give the result of ten*** because this model allows signals to be regenerated and heterodyned through the radio frequency amplifier.

E. I. S. MODEL—All material we furnish is endorsed and recommended by the designers.

Using the finest Apparatus and building to Naval standards, Model C-7 has a telephone range of 3000 miles.

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Free Information—Write for descriptive matter and price list. Our service is as near as your mail box. Special engraving to order.

Full Stock on Hand—We carry complete stocks of laboratory tested apparatus for immediate shipment.

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"ROICE" *Radio Tubes*

The Royalty of Radio Tubes. A powerful and durable tube that will greatly improve reception, increase range and volume with a maximum of clearness.
Our direct sales plan enables you to buy "Roice" at the lowest possible price.

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ALL TYPES **$2.50**

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EVERY TUBE GUARANTEED

to work in Radio Frequency, especially adapted for Neutrodyne, Reflex and Super-Heterodyne Sets.
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Let the non-directional
Thor Speaker Lamp
(Patents Pending)

bring in your Radio programs and furnish light at the same time. Many models—many styles—parchment or any color silk shades. Table lamp models $35. *At your dealer's—or delivered.*

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You can protect tubes against destruction from short circuits for a few cents by installing the "Gem" Radio Fuse. Then when there's a "short," the fuse blows and the tubes aren't injured. Easily installed.
Sent postpaid for 60c with fuse block for attaching, if not at your dealer's.—Write for booklet.
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"GEM" RADIO FUSE

Hints to Constructors

(*Continued from page* 1641)

each other. If, however, they are kept at quite a distance which, by the way, is not usually done, there will be little need for this step. However, be on the safe side and place them in the manner mentioned. Coupling produced by placing the cores parallel to each other will result in distortion of the amplified sounds making the amplifier very unsatisfactory in operation.

OTHER TOOLS

In order properly to go about the construction of a radio receiving set, a certain number of tools should be at hand. A very good stock consists of those illustrated in Fig. 10 with one addition—a hand drill and a set of bits. Even all of the tools illustrated in Fig. 10 are not necessary. The amateur can usually get along without the hacksaw, the metal snips, and the set of small socket wrenches, although all of them often come in handy. The other tools are almost essential. Without them imperfect work will result, and the finished set, while it be perfectly satisfactory electrically, will

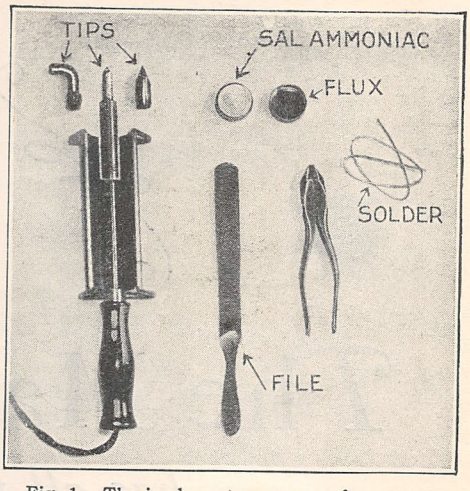

Fig. 1. The implements necessary for executing a good soldering job. Different size tips for the iron are handy to have.

not present a pleasing or symmetrical appearance. With the tools illustrated in Fig. 10 and those used in connection with soldering and illustrated in Fig. 1, the amateur will have a very complete assortment which will enable him to do practically any ordinary work on receiving sets.

MISCELLANEOUS NOTES

Probably more panels are spoiled than any other particular part of radio receiving sets because of inefficient methods used in working with them. Panels today can be obtained in a variety of standard sizes so that it very seldom becomes necessary to cut the panel material. If you do have to do so, however, use a hacksaw with a fine toothed blade for the purpose and saw slowly, not forcing the work. Drilling the panel is about the only work that will usually have to be done upon it. In order to do this properly, the holes should first be located and an indentation made in the panel at the correct point with a center punch, as illustrated. Here we show a template for the mounting of a variable condenser being used for properly locating the shaft hole of that instrument and the mounting holes. The latter are indicated by B and the former by A. The method of using the template, as the sheet of paper upon which the location of the necessary holes are indicated is called, is to place the paper over the panel in the desired place and preferably paste it in position. Then place the point of the center punch on the intersecting lines which indicate the exact center of the hole to be drilled,

ERLA

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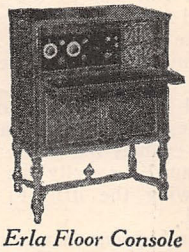
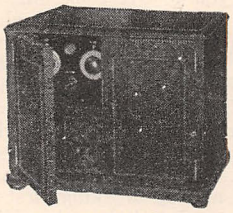
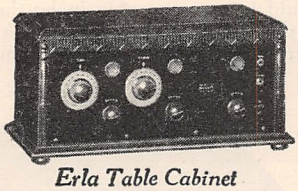


Erla Floor Console



Erla Table Console



Erla Table Cabinet

Erla Radio Instruments, in a complete series of styles, embody improvements which qualify radio as true musical art.

Erla Supereflex makes tubes do triple duty. One tube actually does the work of three that would be needed otherwise. Three tubes do the work of five, unquestionably! That is why simple, compact, inexpensive Erla Supereflex receivers equal or surpass the performance of costliest, temperamental multi-stage radio sets.

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CIR-KIT is a complete assortment of Erla Scientific Precision Apparatus, especially created to make Supereflex possible. *CIR-KIT* provides clear, simple instructions for perfect assembly. Blueprints are full size. The panel is pre-drilled for you. The baseboard is marked to locate every unit accurately. The famous Erla Solderless Connectors do away with soldering entirely.

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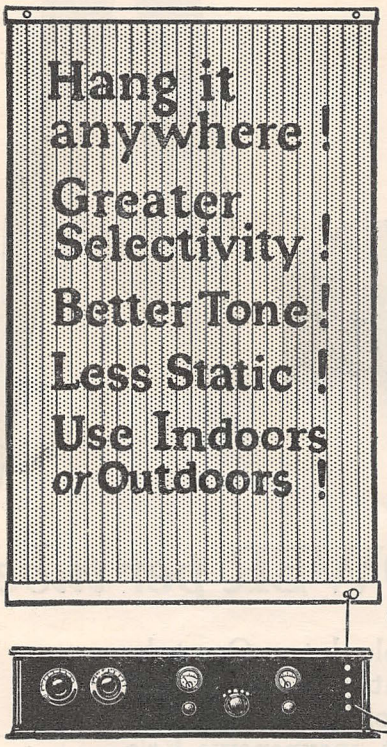

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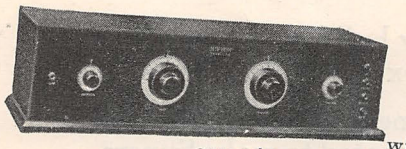

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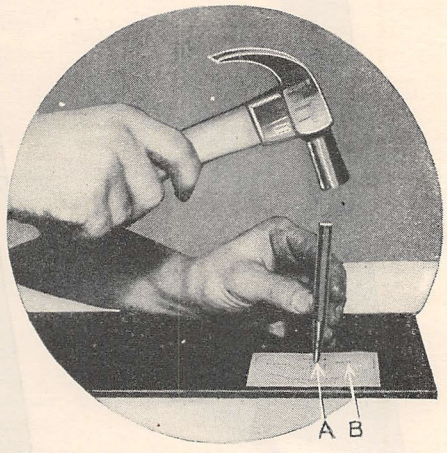
and tap the punch lightly with a hammer. Do this at all points where holes are indicated on the template and then with the hand drill and a bit of the correct size cut the holes in the panel. When the drill has nearly passed through, exert very little pressure on it, for if you do the panel material will split out giving a very unsightly result.



Showing how a center punch is used for marking a panel, through a template, prior to drilling.

Certain companies today are supplying complete descriptions for building radio receiving sets in which they include templates made the full size of the panel. These can be placed in position as described above and all of the necessary holes be drilled in the panel definitely located. The slight indentation made by the center punch through the template and into a panel not only provides correct indication of the location of the hole, but also enables the builder to start to drill quickly and in exactly the right place without allowing the drill to slip and scratch the panel.

It often happens that after a hole is drilled it is found to be slightly smaller than it should be. Here is a little kink that should enable you to overcome this without trying to run a larger drill through the hole. In fact, this kink is most useful when no larger drill is at hand. The idea is to use the tang of a file as a reamer. This is illustrated in Fig. 12. Grasp the file as shown, and holding the panel rigidly, place the tang in the hole to be enlarged and twist it back and forth. The tang will act as an excellent reamer and by working first from one side of the panel and then the other, the desired size can be quickly reached.

Following the above hints on soldering and other points in construction, the builder should have no trouble in putting any ordinary receiving set together. Almost every instrument purchased today comes with the

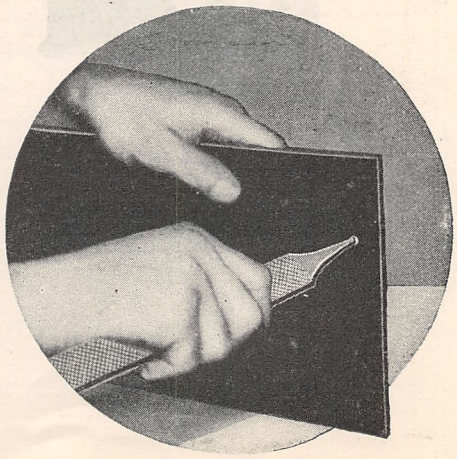


Fig. 12. Holes in panels can be enlarged by using the end of the file as a reamer.

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FACT NO. 1
LOW DISTRIBUTED CAPACITY

Distributed capacity in the secondary winding results in a greatly multiplied capacity acting as a shunt across the primary, which by-passes much of the high frequency audio currents. The resulting losses of the vital harmonics and overtones cause drummy, muffled reception.

In most transformers the high distributed capacity in the secondary causes severe loss in amplification of frequencies above 1200.

Due to the improved coil design of the Karas Harmonik, capacity in the secondary is extremely low and all high frequency harmonics and overtones are equally and fully amplified.

FACT NO. 2
EXTRA LARGE IRON CORE

The size of the iron core and the number of turns on the primary winding govern the amount of magnetic force available for amplification. Flux density and the number of lines of force are exactly proportional to the size of the core cross section. A small cross section therefore limits the amount of magnetic force, and causes a dropping out of the very low and very high frequencies—resulting in added distortion.

Low priced transformers necessarily use but a small amount of iron in the core.

The Karas Harmonik Transformer has an extra large iron core to furnish an easy path for the lines of magnetic force, thus giving full amplification to both the very low and the very high frequencies.

FACT NO. 3
HIGH INDUCTANCE

Accommodation of plate impedances of preceding amplifier tubes at all frequencies depends upon a very high inductance in the primary coil of the transformer. Such inductance can only be gained by a sufficient number of thousands of turns of wire on the primary winding. Lacking a sufficient number of turns, a transformer will lose a large part of the amplification of low frequencies gained in the tube, with consequent distortion of sound.

Manufacturers of ordinary, cheap transformers cannot afford to employ a sufficient number of turns to furnish enough inductance.

The number of thousands of turns on the primary coils of Karas Harmoniks is more than sufficient to develop an impedance high enough to accommodate the preceding plate impedances of all tubes—at all frequencies. Karas Harmoniks DELIVER a large amount of amplification of even the lowest frequencies.

FACT NO. 4
LOW HYSTERISIS LOSS

With each frequency cycle flowing into the iron coil, the direction of the iron molecules must be reversed. Core laminations of inferior iron resist this reversal—wasted energy—termed "hysterisis loss." This waste naturally reduces the amount finally delivered to the secondary coil, resulting in the dropping off of amplification—especially of low frequency sounds.

Manufacturers of ordinary transformers cannot afford to use the high quality of iron in which the molecules are readily reversible. That is another reason why they never give full amplification to low frequency tones.

The special formula iron from which the laminations of Karas Harmoniks are made, has molecular construction that reduces hysterisis loss to a negligible minimum. All the energy is saved for amplification.

FACT NO. 5
CONTROLLED AIR GAP

Uncontrolled air gaps in iron cores offer a high reluctance to the path of magnetic flux. Low frequencies cannot exert their full influence over such a gap; as a result they receive only a small amount of the amplification indicated by the turns ratio of the coils.

To lower manufacturing costs, most transformers are built with jointed core laminations. The joints leave uncontrolled air gaps which cause a dropping off of low frequency vibrations.

Karas Harmonik laminations are made in one piece and so arranged that the effective air gap offers practically no reluctance to the path of magnetic flux. Result—a big gain in amplification, especially of the low frequencies.

FACT NO. 6
NO CORE SATURATION

Small iron cores become saturated at high audio frequencies owing to the audio frequency current producing variations in the flux density which in turn produces corresponding variations in voltage. Result—the introduction of new frequencies. The wave form of the secondary voltage will be different from that in the primary—more distortion.

Low price transformers with their small iron cores must necessarily create more or less distortion due to saturation of the core and the introduction of unwanted frequencies.

The iron core of Karas Harmoniks being greatly over-size cannot possibly become saturated. Therefore there is no possible chance for saturation and the formation of unwanted, distorting frequencies.

FACT NO. 7
SCIENTIFICALLY SHIELDED

When the coils of transformers are unshielded their electrostatic and electromagnetic fields influence each other. They also influence and are in turn influenced by the magnetic and electrostatic fields of other inductances. The result of such intercoupling is—howling.

Ordinary price transformers are unshielded or at best only partly shielded. Such transformers must be placed either at right angles or separated from each other by quite a distance.

Karas Harmoniks may be placed in any position and as close together as the builder wishes. They are absolutely shielded both electrostatically and electro-magnetically from each other and from all other parts of the set. Karas Harmoniks cannot cause howling.

FACT NO. 8
NO VITAL PARTS EXPOSED

Transformers having exposed lead wires between the coil terminals and binding posts are easily tampered with and easily accidentally broken.

Transformers not completely shielded must have some parts of the lead wires exposed.

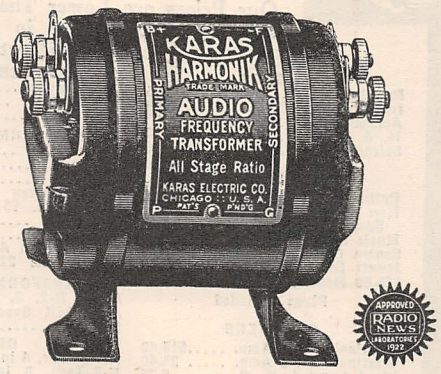
All of the wiring of Karas Harmoniks is enclosed within the scientific shield. The only parts appearing on the outside of the shield are the necessary binding posts with their attached soldering lugs.

FACT NO. 9
HIGH AMPLIFICATION OF LOW FREQUENCIES

The bulk of sound from most musical instruments is carried by the fundamental or lowest of the twelve to twenty "harmonics" of which all musical sounds are composed. These lowest harmonics must be fully amplified if your set is to produce natural, musical sounds.

The hysterisis—reluctance—and impedance losses unavoidable in cheaply made transformers make it impossible for them to give any amplification whatever to extremely low audio frequencies. This makes their delivery of any loud speaker reception exceedingly unmusical and unnatural, because the volume-carrying low frequencies are absent.

Karas Harmoniks reach over 60 per cent of their maximum amplification at 100 frequency, with rapidly increasing efficiency. Thus greatly amplified, these bulk-carrying low frequency fundamental harmonics insure a full, round, rich, natural tone.



FACT NO. 10
COVERS ENTIRE BAND OF FREQUENCIES

High ratio transformers invariably have a peak of amplification. The narrow band of frequencies covered by this peak are blasted out and overbalance other frequencies. The result—unnatural non-musical, irritating sounds.

Cheaply constructed transformers depend upon a high ratio for their amplification. Such transformers deliver a lot of noise, but no music.

Karas Harmonik Transformers by greatly amplifying the volume-carrying low frequencies deliver more total amplification with a low ratio than cheap transformers do with a high ratio.

FACT NO. 11
TRANSFORMERS PERFECTLY MATCHED

The inductance, reactance, and impedance factors of the transformers of a set should be as closely matched as possible. A flat curve, indicating an even amplification over the entire band of audio frequency, is the ideal.

It is very bad practice to provide a high ratio for the first, and a low ratio for the second stage. The first creates a distortion that will be tremendously amplified in the second.

Karas Harmoniks have a comparatively low turns ratio. This favorable factor, combined with their high amplification of fundamental frequencies and all the higher harmonics, prevents distortion in the first stage. Therefore, distortion in the second stage is impossible.

FACT NO. 12
THE IDEAL TRANSFORMER

The ideal transformer must perfectly reproduce and amplify in the secondary circuit all sound currents supplied to the primary circuit. This means reproduction of frequencies (vibrations) ranging from the lowest piano notes (26 per second) to the highest overtones (30,000 per second).

From a scientific standpoint, the ideal audio frequency transformer should be a very large affair, costing from $25.00 *to* $30.00 *to manufacture and retailing at a prohibitive price.*

Karas Harmoniks embody all of the favorable factors of the perfect transformer so well that no one but an expert musician can detect the difference between the two in quality of the amplified music.

AN EXCEPTIONAL MONEY-BACK GUARANTEE

Instead of the usual meaningless guarantee of "material and workmanship," Karas Harmoniks are backed by a straight-from-the-shoulder money-back guarantee of satisfaction. Put a pair of them in your set. Use them for 30 days. If you do not feel that they are giving you far better reception than you have ever heard before, return them to your dealer. He is authorized to return your money immediately.

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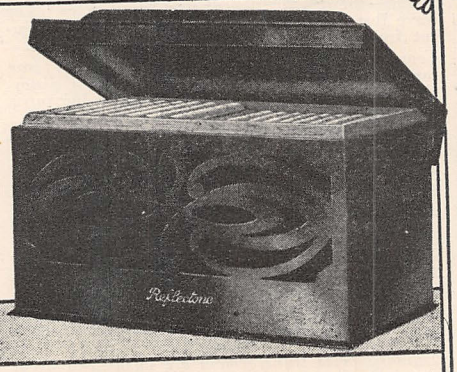

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Place it on the smoking stand, or in your library. Tune in. Anything. Dance music, or a delicate solo. Each note will be heard as though you stood beside the performer—full, natural, beautiful.

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template, and in case the builder does not purchase one of the complete templates mentioned above, he can, by laying these individual templates out on the panel, accurately locate and drill each and every hole. The instruments need then only be fastened to the panel, the connecting wires placed in position and each joint that is not clamped in a binding post, soldered. This procedure will almost invariably be conductive of good results, unless the builder makes a mistake in his wiring, which, of course, involves that human element which can only be controlled by one person; in this case, the builder. Always be sure to check and recheck every wire and connection before putting the set into service to prevent accidents and disappointment later on.

When Buying Vacuum Tubes

(*Continued from page 1665*)

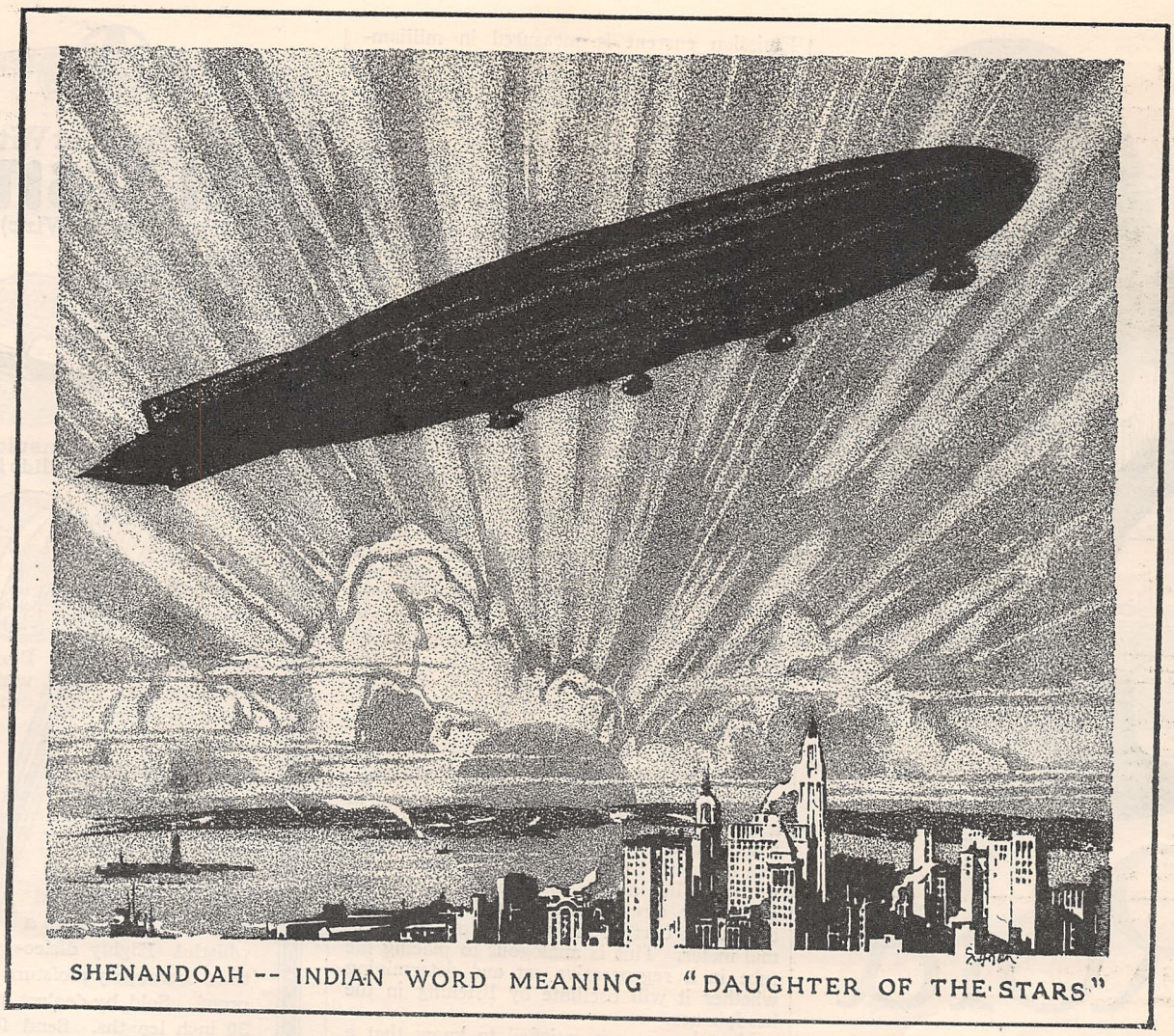
However, the gas cannot penetrate the glass and pass through it. The gas clean-up may, therefore, be caused by the above-mentioned absorption, but is due mostly to the burning of the filament, which seems to absorb the gas when lighted. The exact theory of this clean-up caused by the filament is not understood, but it has been demonstrated experimentally. In fact, in the 201A and 199 tubes the filament is depended upon to clean up the last traces of gas.

PLATE CURRENT TEST

Another test reading which is not of such great importance, but one which dealers try to attach a great deal of importance to, is the plate current reading. The proper amount of importance that should be attached to this reading will be explained below. The plate current is that which flows through the tube out of the "B" batteries. It is dependent on the plate or "B" battery voltage and also on the grid bias, increasing in value as the plate voltage is increased and decreasing in value as the grid bias is made more negative. With the same plate and grid voltage, however, two tubes will not necessarily have the same plate current. The plate current of a tube is dependent on two intrinsic factors of the tube, namely the amplification factor and the plate impedance. These two inherent quantities are very seldom exactly alike in two tubes, but vary within certain limits. Therefore, the plate current will quite often be different for different tubes. Furthermore, if the plate current of two tubes is the same, it does not necessarily mean that their amplification factors and impedances will be the same. The reason for this lengthy discussion is due to the fact that some dealers have a small test set manufactured by a reputable instrument company, which is able to read a number of values of a tube, but requires the plotting of curves to do so. Outside of filament and plate voltages and filament current, the only thing that can be read directly is plate current, which tells you very little. But due to the ease with which the plate current can be read, dealers are prone to test tubes in the presence of the buyer until they find the required number of tubes that have the same plate current. This is a lot of what is commonly known as "bunk." Furthermore, it is really desirable to have tubes each with different characteristics, as it may be found by experimenting that one works better than another in a certain position in a set.

FILAMENT EMISSION

Still another important reading, which manufacturers note, is that of emission.



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In the air, as on the sea, radio equipment must be the most reliable it is possible to get. That is why the Shenandoah, the huge ship Leviathan —in fact, many government and commercial radio plants—were equipped with Exide Batteries.

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There is an Exide type for every tube and a size for every set: "A" batteries for 2-volt, 4-volt and 6-volt tubes; "B" batteries, 24 and 48 volt, of 6000 milliampere hour capacity. They are efficient, dependable, long-lasting — and right in price. Exide Batteries are made by the largest manufacturers of storage batteries in the world.

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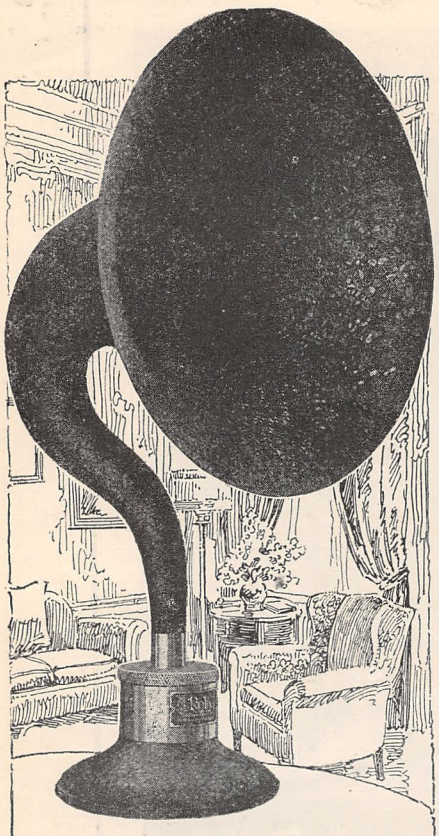
Exide
RADIO BATTERIES

FOR BETTER RADIO RECEPTION USE STORAGE BATTERIES



Rola

ACHIEVEMENT—

A NEW STANDARD in radio reception has been achieved in the Rola Re★Creator.

Exquisite tone quality—master of every note in the orchestral range. Sensitivity that will reproduce any signal that can be amplified. Volume unequalled—without chatter, without discord.

A demonstration is the acid test. Hear the Rola at your dealer's for convincing proof.

PRICE COMPLETE WITH FOURTEEN-INCH HORN & CORD
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SEATTLE, WASHINGTON · USA

Distributed nationally to the jobbing trade by BAKER-SMITH COMPANY, 4250 Hollis St., Oakland, Cal., *with offices in the principal cities*

Emission current is measured in milliamperes, the same as the plate current, and is a measure of the total number of electrons given off by the filament at its rated current. Another term that could be applied is saturation current. This can easily be read by connecting the grid to the plate and reading the current that flows in the plate circuit, as illustrated in Fig. 3. For the 201A type this emission current should be above 30 milliamperes and for a 199 should be 6 milliamperes or more. If a meter is not available that will read 30 milliamperes, but a 5-milliampere meter is in the plate circuit, the emission of a 201A may be checked by reducing the filament voltage to 3.65 volts and noting that the emission current (plate and grid connected) is at least 5 milliamperes. The emission of a UV-199 can be tested in the same manner by setting its filament voltage at 2.8 and noting that its emission current is then 3 milliamperes or more. The amplification constant and impedance of a tube cannot be very easily measured, but their absolute values do not need to be known exactly. One rather approximate way of telling if these factors are about where they should be is to note the plate current of the tube as measured by milliammeter "MA" in Fig. 1, at rated filament current and voltage, with 60 volts on the plate and 1½ volts negative bias on the grid. The plate current should then be between one and three milliamperes.

OSCILLATION AND AMPLIFICATION

One type of test set that can be found in a few stores has but three meters, a filament ammeter and voltmeter and a thermal meter that will read high frequency currents. When a tube is inserted, it is in an oscillating circuit and its radio frequency oscillation current is indicated on the thermal meter. This is analogous to placing the tube in a regenerative set and determining whether it will oscillate by listening in the headphones.

Most buyers are satisfied to know that a tube will "talk" by placing the tube in a set and listening to the volume. This tells you almost as much as does a test set, but it is suggested that when testing a tube in a set it is advisable to test it in three places, radio and audio frequency and as a detector.

In concluding, it might be well to mention the life of a tube. There has not been as yet, and it is doubtful if there will ever be, a method devised for predetermining the life of a tube. This is one thing you take a chance on, but most tubes are guaranteed for a certain length of time on the condition that the filament is not burned out.

Furthermore, in buying a tube, stick to the standard design, and do not "fall" for "the beautiful reproduction" produced by some auxiliary element that is fastened to the filament support and is "the result of years of research." When a new idea is indorsed by leading radio engineers and their O. K. is upon it, then is the time to use it.

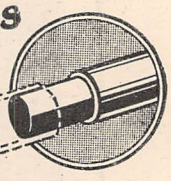
The Old Dobbin Circuit

(*Continued from page* 1675)

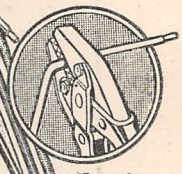
characteristic, the set is exceptionally easy to calibrate. And this is no mean advantage in these days of trans-Atlantic tests. A vernier dial is included, as it is absolutely necessary in view of the selectivity of the apparatus.

The placement of the apparatus shown in the photograph of the set is recommended. It may look a bit amateurish at first glance on account of the long leads to the variable condenser, but since the crystal is as near the tuner as possible, the condenser does not matter very much. And it adds stability, if anything, to the ensemble.

Wire Your Set With "CELATSITE"
(Spaghetti Wire)
5 Colors



Cut Insulation and slide it off



Bends without cracking

You can't beat this for a neat job. It is No. 14 tinned copper wire covered with a varnished insulation in 5 beautiful colors. Looks like "spaghetti" but is smaller and goes into narrower places. It bends without cracking and strips like the bark on a whistle! Highly dielectric; thoroughly moisture proof. Sold by dealers in 30 inch lengths. Send for

Free Folder Telling HOW TO SOLDER

This folder also describes Acme "Celatsite", Spaghetti, and Stranded Enamel Antenna.

THE ACME WIRE COMPANY
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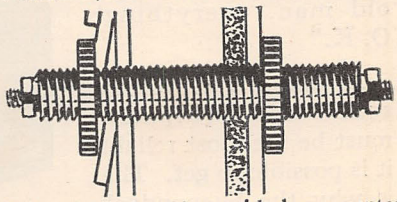
ACME WIRE
Makes Better Sets

M & M
Lead-In Insulators
Weather, Storm and Water Proof



Made of hard rubber with brass center.
4" Lead-in Window Insulator for sash, 50c
10" Lead-in Wall Insulator for casings and walls 80c
JOBBERS and DEALERS Write for our proposition
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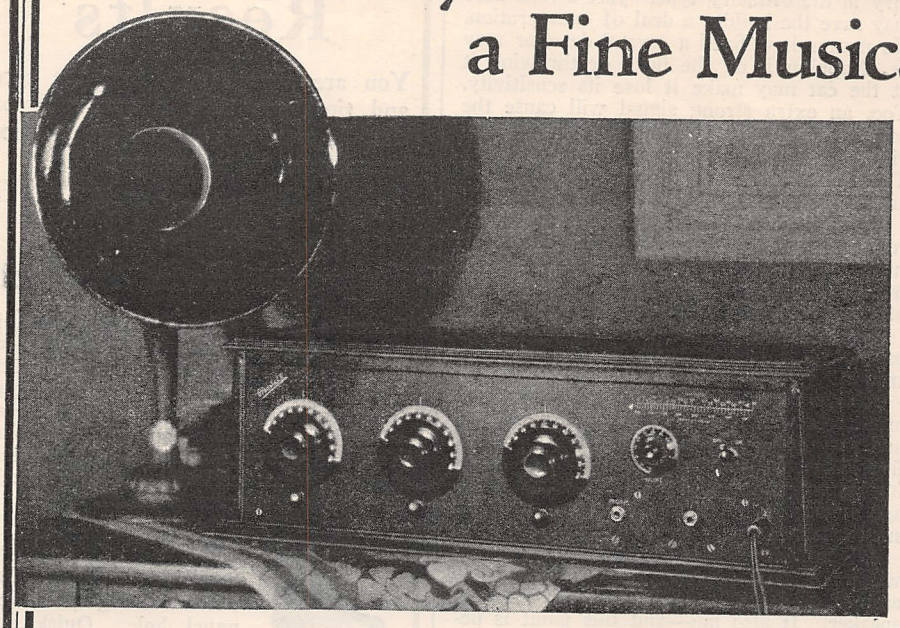
Not Merely a Clear Receiver, but a Fine Musical Instrument



Brings out the Overtones— the Rich Timbre of both Music and the Human Voice

Radio is becoming as much of a household convenience as the telephone. It should be just as dependable and true. Quality of tone is the supreme test. Distance can always be obtained by sufficient amplification. The problem is to secure distance without distorting or blurring the tone.

For years radio engineers have realized this. While the public was going wild over reaching out for distance, they were quietly exhausting every resource in experimentation to overcome the internal noises which increased with every new stage of amplification. The same steps which amplified the tone also amplified the stray oscillations within the set itself, as a by-product.

Nobody knew how to prevent them. Various means were employed to choke them or neutralize them. Potentiometers, extra condensers, complicated wiring were employed with only partial success. They work only when perfectly adjusted, and their operation interferes with a perfectly pure, free, flexible tone. By absorbing the true signal as well as the stray energy, they lose or blur those delicate overtones which make real music. They cannot prevent the conflict which occurs in the circuit between the forward stream of radio energy and the feedback of stray energy, blotting out the overtones.

The real trouble was this: No structurally correct long-distance radio system had been designed. All designs up to date generated feedback of stray energy which chattered, howled and squealed unless choked down or neutralized; and radio reception, while accomplishing wonders, was still a makeshift.

A New Capability in Radio: Overtones Perfectly Reproduced

Pfanstiehl's big contribution to radio lies in his discovery of the real causes of oscillations and his complete elimination of them by a circuit system which KEEPS THEM OUT. No choking or neutralizing elements are any longer needed. No adjusting is required. The receiver is always at its best. Tuning and operation are absolutely quiet. The tone or voice comes in sweetly, in all of its natural richness. All of the overtones are perfectly reproduced, exactly as transmitted. This is true of long distance. High amplification doesn't distort. His invention has turned radio from a stunt device, for fans to play with, to a dependable, enjoyable and trouble-proof instrument in the home —the thing it should be and was destined to become.

See the new Pfanstiehl at your radio or music dealer's. If he does not have one to show you, we can quickly get it to him.

Dealers: Write for the Pfanstiehl proposition.

PFANSTIEHL RADIO COMPANY

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Pfanstiehl

OVERTONE RECEIVER

A 5-tube Receiver using the new system of tuned radio frequency

"MODERN RADIO RECEPTION"

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By

Charles R. Leutz

325 PAGES
200 ILLUSTRATIONS
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and
Everything of importance relating to Broadcast Reception

This supersedes Mr. Leutz's earlier book entitled "Super-Heterodyne Receivers."

Price $3.00 Postpaid

EXPERIMENTERS INFORMATION SERVICE, Inc.

476 Broadway New York City

A crystal of the fixed type is used in this case. It is of the cartridge type and is placed between the two clips mounted at the center top of the panel. This type will be found best for use, since it does away with the annoyance of constant adjustment necessary in the ordinary type. Just a hint here may save the builder a deal of exasperation. No matter how fixed a crystal detector may be, dropping it on the floor or throwing it at the cat may make it lose its sensitivity. Too, an extra strong signal will cause the point to burn out. Therefore, it may be advisable to have an extra refill for it at hand. The ordinary type may be used, but the fixed one seems to be the lesser of two evils.

An aperiodic primary is used on the tuner, reducing the controls. It consists of six turns placed directly on the bakelite strips which support the secondary. It should be of large wire, No. 14 serving admirably.

The location of the instruments on the baseboard is clearly indicated in the illustration.

Ninety volts of "B" battery were used on the plates of the tubes which were 201A's and very good volume was obtained. Local five kilowatt stations have a habit of causing distortion in the set with this high voltage, however, so be careful when tuning in such transmitters.

All in all, this is a reflex idea worth while. It has stability and a reasonable amount of added signal strength at the loud speaker. It also has—and this point is becoming more and more important—perfect clarity of reproduction on account of the use of a crystal as the rectifier.

A Triode Antedating DeForest's Tube?

(*Continued from page 1671*)

the invention relates to a device for releasing energy in a relay manner, and it definitely mentions *telephone* and *telegraph relay* purposes as its object, as well as the carrying of *wireless telephone* messages, the amplifying and building up of *speech* and *music* transmission, and *telephotography*.

Von Lieben also clearly states that he desires to utilize a vacuum in which an electronic stream will be emitted in a circuit with a potential of 200 volts. This clearly outlines the degree of vacuum in use today in the modern radio receiving tube concerning which a controversy between Arnold and Langmuir is now raging, there being two conflicting patent claims before our Patent Office Board of Examiners, in which the use of a "hard" vacuum is claimed. These patents on the vacuum question have not been issued.

It will be noted in the circuit shown by Von Lieben that he provides for a "B" battery, and for a "C" battery in the external circuits connected to the tube electrodes. He also takes up the proposition of transmission and mentions the use of a microphone in the grid circuit, even showing its position.

Another point is that the external circuit of the collector electrode shows the positive terminal of the "B" battery connected to the plate, and that *a means of feed-back* is shown in "apparatus A," though not claimed in the patent specifications.

THE WEHNELT OXIDE COATING

Altogether, this Von Lieben patent has a very strong bearing on the development of the vacuum tube today, for it shows a structure which will be very important in the coming 110-volt receiving tubes which are due to be placed upon the market within a short time. The Wehnelt oxide coating as a source of electron emission has withstood the test of science for more than 20 years. The

For Better Results

You are always sure that the care and time you take in arranging or changing and wiring your set will not be misspent when you use

YAXLEY
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Examine any Yaxley Product. Take it apart. You will see many exclusive refinements in design and construction which make for better results in your receiving. The increasing number of manufacturers of high grade radio equipment adopting Yaxley Approved Radio Products as standard is the best testimonial of their worth. It is your assurance of satisfaction.

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Small and compact. One nut mounting in single panel hole. Quick and positive snap-break contact. Each..... .60

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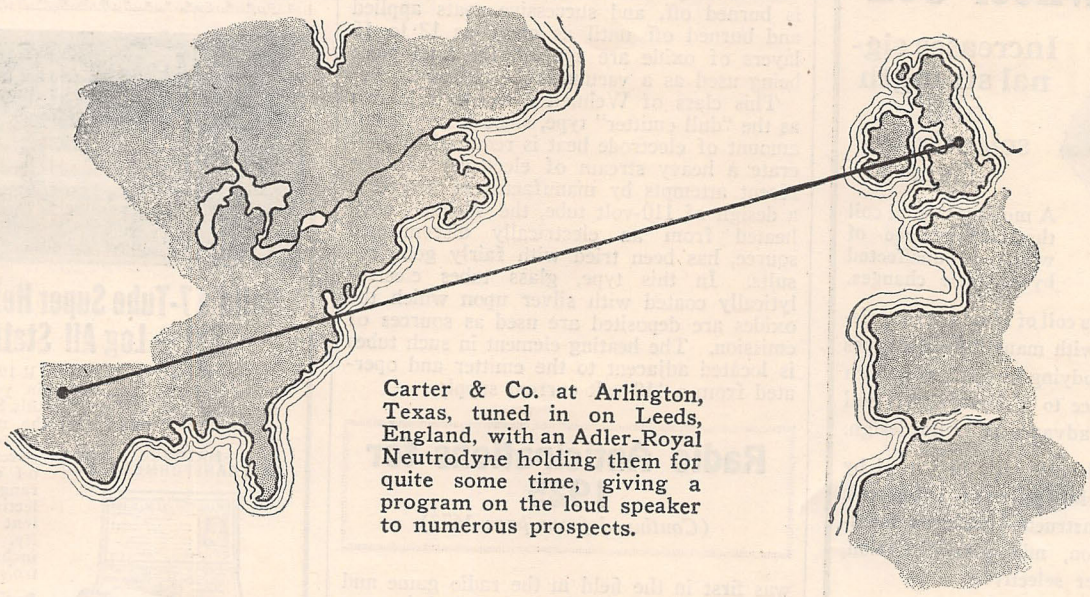
Two big radio thrills



Carter & Co. at Arlington, Texas, tuned in on Leeds, England, with an Adler-Royal Neutrodyne holding them for quite some time, giving a program on the loud speaker to numerous prospects.

YOUR first thrill with an Adler-Royal neutrodyne will be the magic spell of D.X. as station after station comes in clear as a bell with the slightest change in dial settings. No matter how much you know about radio, the performance of Adler-Royal will be a remarkable radio experience for you. The selectivity you had hoped for has really been accomplished.

Then as your own log grows you will be more discriminating about the quality of what you hear. You will begin to appreciate what Adler-Royal really is and this will be your biggest thrill. Your daily paper will be your program. You will learn to depend on Adler-Royal absolutely.

The Neutrodyne principle is so far perfected in Adler-Royal that even in the hands of a novice its selectivity and pure tone qualities are almost automatic. Its operation is as simple as setting a clock. There are no squeaks, squeals or howls to ruin radio enjoyment. Adler-Royal has conquered the mysteries of the air.

Seek a Service Dealer

The dealer from whom you buy a radio set is quite as important as the set you buy. On his service to you, much of your enjoyment of a radio set will depend. It will pay you to turn the corner into Main Street to find the Adler-Royal dealer. He is appointed by us on his pledge to give purchasers the best of every service. On Adler-Royal, you get the guarantee of a high-class dealer to back up ours.

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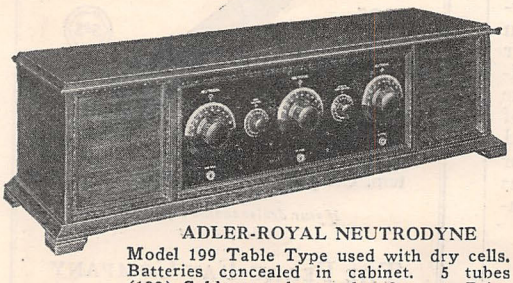
ADLER-ROYAL
Phonograph and Radio



ADLER-ROYAL NEUTRODYNE
Model 199 Table Type used with dry cells. Batteries concealed in cabinet. 5 tubes (199) Cabinets walnut and mahogany. Price $165. Complete $205.

Licensed by Independent Radio Manufacturers, Inc. Reg. U.S. Pat. Off. NEUTRODYNE Pat. March 27 1923 and April 1, 1924 Hazeltine Pats. Nos. 1,450,080 and 1,489,228 Other Patents Pending. U.S. Pat. Off.

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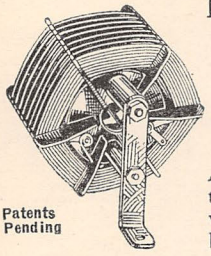
The Andrews Paddlewheel Coil



Patents Pending

Increases signal strength and selectivity

A moisture proof coil the performance of which is unaffected by climatic changes.

A NEW low loss coil of ideal characteristics for use with many different types of circuits. Embodying an extremely high ratio of inductance to resistance, this coil marks a distinct advance in radio design.

Your results will be greatly improved by using this superior piece of apparatus. Its exclusive construction assures maximum amplification, minimum distortion, and much greater selectivity.

This coil, which is the type employed in the Andrews Deresnadyne Receiver, is manufactured under license from the Andrews Radio Company.

Price $3.00

Write for full information regarding this wonderful new coil, its characteristics and its uses.

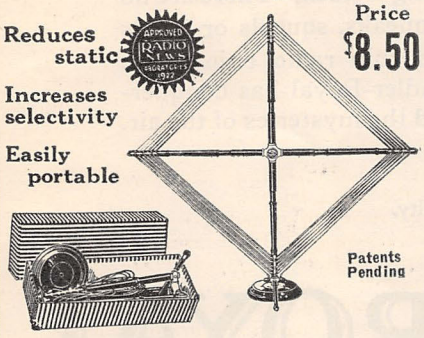
Duo-Spiral Folding Loop

Price $8.50

Reduces static

Increases selectivity

Easily portable



Patents Pending

The highest development in a portable aerial. Rotates on base, which is provided with silvered dial graduated for calibration. Handle permits adjustment without body capacity effect. Handsomely finished in silver and mahogany. There is a DUO-SPIRAL model for every circuit.

TINY-TURN

A superior vernier control which makes perfect tuning easy. Has a gear ratio of 30 to 1. Rotates in same direction as dials. Easy to install. Fits any panel. Handsome nickel and ebony black finish. Price 75c.

Write direct, if your dealer is unable to supply these standard products.

Radio Units Inc.

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PERKINS ELECTRIC, LTD., MONTREAL

Western Electric Co. has practically adopted the Wehnelt coating in every department of their tube work.

In manufacturing tubes which utilize Wehnelt-coated sources of emission, the craftsman makes a compound of strontium and barium oxides with resin, wax or paraffin, in a sort of soft, doughy solution. This compound is painted on strips of platinum-iridium alloy. As each painted coat dries, it is burned off, and successive coats applied and burned off until as many as 12 to 15 layers of oxide are applied, the final piece being used as a vacuum tube filament.

This class of Wehnelt filament is known as the "dull emitter" type, since a very small amount of electrode heat is required to generate a heavy stream of electrons. In the recent attempts by manufacturers to create a design of 110-volt tube, the Wehnelt coat, heated from an electrically disconnected source, has been tried with fairly good results. In this type, glass tubes electrolytically coated with silver upon which the oxides are deposited are used as sources of emission. The heating element in such tubes is located adjacent to the emitter and operated from a 110-volt current supply.

Radio Anticipations for 1925

(*Continued from page* 1673)

was first in the field in the radio game and that we have a tremendous vested interest which ought to be considered. The use of radio is of military necessity and for the sake of the safety of our own ships, as well as merchant vessels, there is also a necessity in peace time for radio. Therefore, it is neither reasonable nor possible to shut down a Government or commercial station offhand, simply because the broadcast listeners complain of it.

"Nevertheless, as far as the navy is concerned, I can assure you that we are making every effort to reduce the interference caused by our stations. If the work seems to progress slowly, it is because the ordinary broadcast listener does not appreciate the tremendous technical difficulties involved and the very great cost of the conversion of such a large number of stations afloat and ashore to stations of the non-interfering type. Our efforts are, moreover, hampered by the unwillingness of broadcast listeners themselves to use suitable receivers.

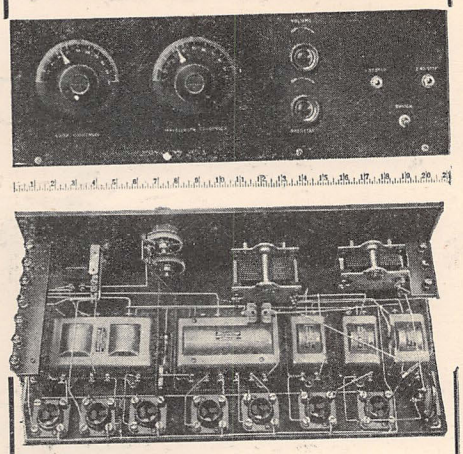
"However, our work is progressing systematically and regularly and we have made many concessions and spent many hundreds of thousands of dollars in improving conditions both afloat and ashore, and as rapidly as possible and as fast as the money is available, are scrapping old equipment even though much of it is still capable of excellent service from a naval point of view.

"Incidentally, a large amount of interference has been charged to naval stations which investigation has shown not to have originated with them. This is the result of broadcast listeners failing to learn a few letters of the code, thus enabling them to identify a station's call. Broadcasting, however, has done the naval radio interests an immense amount of good. Most of our naval officers, whether they be in communication work or not, from their experience with broadcast receivers, know something of the radio game and talk its language. I think broadcasting is largely responsible for a better appreciation of the possibilities as well as the difficulties of radio communication in the naval service.

THE SELECTIVE RECEIVERS

"The man on a rural telephone line, where a number of parties are on the same line, with more or less inadequate operators, can not expect the same service as the man who

BRANSTON RADIO



Build a 7-Tube Super Heterodyne Set—Log All Stations

Using Branston Kit No. R-199, you can build a far better set than you can buy for much more money. In this Super Heterodyne Set 7 tubes give the usual results of ten. It is a strictly loop set of coast-to-coast range, great selectivity, excellent tonal quality. Panel 7x21 inches. 2 Controls.

8 MATCHED TRANSFORMERS $35

Branston Kit No. R-199, 3-stage long wave R. F. Transformer, Twin A. F.'s, Single Stage Long Wave R. F., Long Wave Tuned R. F., Special Tuned Coupling Transformer, Short Wave R. F. Matched and given operation test.

Partially Assembled Accessory Kit, $50

Saves time and insures highest class of parts. Contains drilled and engraved panel with condensers, rheostats, battery switch, jacks, etc., mounted. Sockets, subpanels, wire, spaghetti, etc., etc. When ordering be sure to specify kind of tubes you intend to use.

Send for Blueprints and Catalog

Send 25c in coin or stamps for complete blueprints and layout covering Super Heterodyne, Radio Frequency and Honeycomb Coil Circuits; also complete catalog of Branston Quality Radio Products.

Your dealer has Branston Kits or can get them for you.

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Set-O-Six Radio Socket Wrench

$1.25

A solidly-built wrench for every radio need. Reaches and fits every round and hexagon nut on any set; works with a fast, screw-driver turn. Compact, light, and handy.

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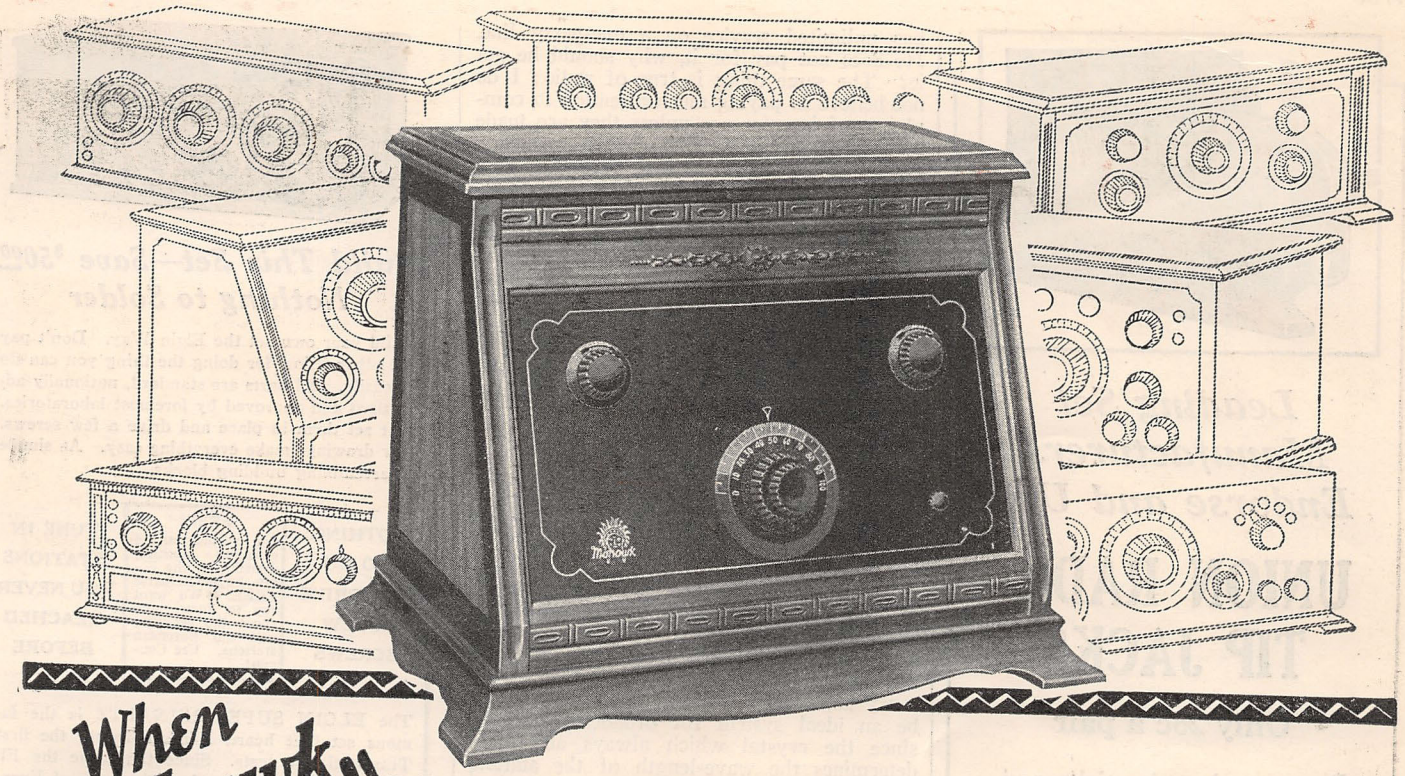
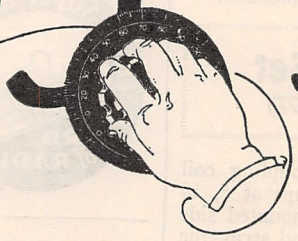
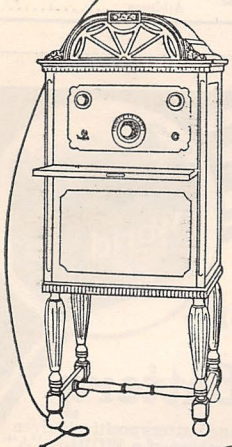


When Mohawk Says:- "Just ONE Dial to Tune"

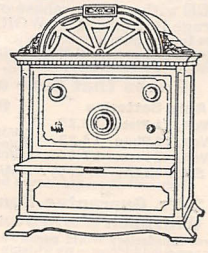
It Means Just That!





MOHAWK SETS

are a quality product through and through, broadly and fully guaranteed. Built in THREE MODELS. Each encased in a distinctive type, hand-carved, Adam-Brown walnut cabinet instantly appealing to the artistic taste of the most critical. Console models have LOUD SPEAKER and battery compartment built right into the cabinet.



"Imitation is the sincerest form of flattery,"—and the nation-wide sensation which the "Just **one** Dial To Tune" feature has created for the MOHAWK 5-Tube models, made it a foregone conclusion that others would play "follow the leader." But once you make a careful inspection of most other so-called **one** Dial sets it is dollars to doughnuts that somewhere in their make-up you will find two or three extra controls carefully disguised so they will not look like dials.

When MOHAWK says 5-Tubes with "Just **one** Dial To Tune" it means exactly what it says. It is not a mere claim. There is not a particle of exaggeration or subterfuge about the **one** Dial Control on the MOHAWK. It has been designed and built from the ground up with that one idea in mind—to give complete control of 5 tubes on just **one** Dial. Just **one** Dial to turn to get coast to coast range,—crystal clear reception without distortion—and super-sharp selectivity like a razor edge.

You have never heard real Selectivity until you hear the MOHAWK. Without headphones, but direct on the Loud Speaker, you cut through local stations with ease and bring in scores of distant stations scarcely more than a hair apart on the wonderful **one** Dial. The resulting greater beauty of tone, close reproduction and loud speaker volume far exceed the finest reception ever known heretofore. Don't make a move toward buying a receiver until you read our descriptive literature and proof that the new MOHAWK with just **one** Dial will surpass the performance of any other set—and at no greater cost.

Write for the new facts—send the coupon NOW!

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The Mohawk 5 Tube Receiver

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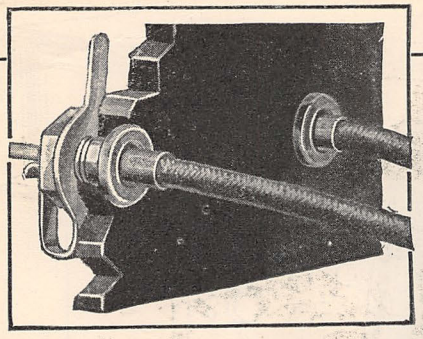
Address .....

Please mention your local Radio Dealer's Name.



Leading Set Manufacturers Endorse and Use

UNION RADIO TIP JACKS

Only 25c a pair

Because they give tight, positive contacts.

Because there are no parts to lose.

Because they improve the looks of the set.

Because all you have to do is plug in.

Will firmly grip any wire from No. 11 to No. 24 B & S gauge and can easily be reamed to hold antenna wire and loading coils.

Three Sizes for All Mountings

Standard Type A for panels 3/16" to ¼" thick.

Special Type B for panels, cabinet walls and partitions 5/16" to ½" thick.

Special Type C for panels up to ⅛" thick.

Other Guaranteed Union Radio Parts

TUBE SOCKETS: Of highly polished moulded condensite. Phosphor bronze contact springs. Reinforced bayonet slot. For all standard tubes. Price 70c.

DIAL ADJUSTERS: for minute adjustment of dials, necessary in close tuning. Price 60c.

RETAILERS—WHOLESALERS!

Write for free samples. Get details of our dealer proposition. Ask for illustrated pamphlet C.

UNION RADIO CORPORATION
124 SUSSEX AVENUE, NEWARK N.J.
NEW YORK OFFICE 116 WEST 32nd STREET.

has unlimited service on a one-party line. He does not pay for it, why should he get it? The same thing is true of radio; I do not believe in paying much attention to complaints of interference unless they are made by people who have really selective receivers. If the public insists on such receivers, they will get them as soon as they are manufactured in sufficient quantity, at much less cost than they now get them. If they really want the radio art to develop and perfect itself, particularly in the broadcast field, they should not throttle the art by trying to get rid of interference by shutting up the interfering stations unless such stations really have a type of emission which can not be discriminated against with a good receiver.

"The outstanding development of the last two years is in transmission with high frequencies. In this field the navy has taken a very active part. Much is yet to be learned, but it would appear that much further development will take place in the coming year in this field.

"Perhaps the greatest problem today is the accurate regulation of frequencies. I think this will be solved by the use of the Piezo electrical effect of quartz crystals. This station already has a set controlled by a crystal, using a 20-k.w. tube. This would be an ideal system for broadcast stations, since the crystal which always absolutely determines the wave-length of the station, can be ground to just the right dimensions to correspond to the allotted wave-length of that station. There is no possibility of that station drifting off tune. I expect, therefore, to see a marked increase in the use of quartz crystal control for steadying frequencies."

The Radio Uni-Set

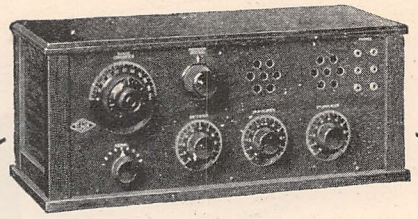
(*Continued from page* 1677)

the exception of the antenna coupling coil which has 20 turns total with taps at 5, 10 and 15 turns. These coils are mounted side by side on a paraffin treated wood strip, the whole support of the coils being afforded by inserting the end terminal wires tightly through small holes drilled in the treated wood strip. No screws or binding posts are necessary to such mounting. Some small variation of coupling is possible by tilting the coils to one side or the other. A close coupling of the plate coil to antenna coil is desirable, but the grid coil and modulation coil are preferably coupled more loosely by tilting them out of the plane of the two middle coils by an angle of about 40 degrees. When once adjusted, the coupling of all coils remains fixed.

Needless to say, the variable condenser VC_1 should be of low loss design and equipped with a vernier control which will in no way prevent a rapid movement of the rotor plates. It has a capacity of .0005 mfd. This condenser closely shunted around the 16 turn grid coil enables a wave-length range of from 55 meters to 202 meters, thus taking in both of the higher amateur wave bands.

THE ANTENNA SYSTEM

Along with a brief description of the operation of the "Uni-Set," I might first give dimensions of the antenna and counterpoise which I employ. The antenna is a single copper wire No. 10 B & S, 65 feet long, with an additional 21-foot lead-in. The horizontal portion is 50 feet above the ground on the far end and 24 feet at the near end. The counterpoise is a single copper wire No. 10 B & S, 65 feet long, 7 feet above the ground and directly under the antenna. This antenna and counterpoise with the full 20 turns of the antenna coupling coil gives a wave-length for the antenna circuit of 152 meters. With the switches S_1 and S_2 in the transmitting position, it is only necessary to go slowly



Build This Set—Save $50.00
Nothing to Solder

Build your own set the Elgin Way. Don't pay the other fellow for doing the thing you can do so easily. All parts are standard, nationally advertised and approved by foremost laboratories. Just set them in place and drive a few screws. Our drawings make everything easy. As simple as assembling building blocks.

NOTHING TO DO BUT DRIVE A FEW SCREWS

FREE! Let us send you the complete working drawings of the Elgin Super-Reinartz FREE. We want you to know more about the set that logs the European stations. Use Coupon!

TUNE IN STATIONS YOU NEVER REACHED BEFORE

The ELGIN SUPER-REINARTZ is the famous set that heard London during the first Trans-Atlantic tests. Since that time the Elgin Super Reinartz has logged scores of European stations. Thousands of fans—everywhere—attest its superiority. *Read our FREE offer to you!*

Elgin Super-Reinartz The FORD of RADIO

- - - - TEAR THIS OFF - - -

Elgin Radio Supply Co., Suite C, 209 E. Chicago St. Elgin, Ill.
I want to know all about the ELGIN SUPER-REINARTZ. Send the drawings—FREE——no obligations on my part. I enclose a stamp for postage.

Name .....

Address .....

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To Each Purchaser of a World Battery

A 24-Volt "B" Storage Battery positively given FREE with each purchase of a WORLD "A" Storage Battery. The WORLD Battery is famous for its guaranteed quality and service. Backed by years of Successful Manufacture and Thousands of Satisfied Users. You save 50%.

Prices That Save and Satisfy

Auto Batteries		Radio Batteries	
6-Volt, 11 Plate	$12.25	6-Volt, 100 Amps.	12.50
6-Volt, 13 Plate	14.25	6-Volt, 120 Amps.	14.50
12-Volt, 7 Plate	17.00	6-Volt, 140 Amps.	16.00

Shipment Express C. O. D. subject to examination. 5 per cent discount for cash in full with order.

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proves satisfactory World performance. Mail this ad with your name and address — we will ship battery day order is received; and give you your choice of "B" Storage Battery or a handsome nickle finish Auto Spotlite, FREE. Write TODAY.

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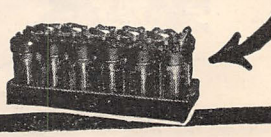
This FREE "B" Storage Battery takes the place of dry cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for $6.00. It is the only battery of its kind equipped with solid rubber case—and insurance against acid and leakage. Take advantage of this remarkable introductory offer NOW. To those who prefer it, we will send FREE a handsome nickel finish Auto Spotlite, instead of the "B" Battery. Be sure to specify which is wanted.)

GIVEN FREE
To introduce this new and superior World "B" Storage Battery to the Public.



through the range of the grid variable condenser to put the oscillator circuit in resonance with the antenna circuit, which condition will be indicated by maximum antenna current.

With the above described antenna system and the 5-watt oscillator with 500 volts plate potential, the antenna current is .8 ampere. For the 75- to 80-meter waveband, a series antenna condenser is inserted external to the "Uni-Set" and the clip changed to the 10-turn tap on the antenna coupling coil. This series condenser is adjusted to give the antenna system the desired wave, say 80 meters, and the grid variable condenser then adjusted for resonance. At 80 meters, with same oscillator and antenna system, the antenna current is .4 amperes. There will be these two definite settings of the condenser VC for transmitting; that is, a setting for each wave-length, 80 and 152 meters. Then the grid condenser VC must always be set back to one of these settings when changing from receiving to transmitting, the setting depending upon which wave-length is being employed at the time. This adjustment is not critical, particularly at the 150-200 meter range where one or two degrees either side of the optimum does not change wave-length or antenna current perceptibly. At the 75-80 meter range, the adjustment must be a little more accurate, but it is not critical at all.

"The proof of the pudding is in the eating," and so the writer has been losing sleep during the past couple of weeks to see if the "Uni-Set" might be worthy of a DX rating. I have been reported QSA on both waves, 80 meters and 152 meters, by amateurs in practically all districts with whom C.W. communication has been established. A general CQ call on 80 meters one favorable morning (2:40 A. M.) "raised" about five different Pacific Coast amateurs. Signals were reported being received with an audibility of 6 at Bahia Blanca, Argentina, S. A. (rDB2), on a two-tube "1BGF" receiver. The combination of D.C. filament supply from storage battery and a good 500-volt D.C. generator with a 10 mfd. condenser across the output to smooth out any commutator ripples results in producing a pure, penetrating D.C. note on C.W. transmission, which has caused favorable comment from practically all of the amateurs which have been worked and several have inquired if storage batteries were being employed for plate voltage supply.

The "Uni-Set" can be used with a UV-201A tube as an oscillator and 250 volts plate potential from "B" batteries or other plate supply and will give a daylight transmitting range up to 50 miles, with a night time range of several hundred miles under favorable conditions.

Of course, when the UV-201A tube is used, the ordinary 6-volt storage battery can be used and the fixed filament resistances altered to provide proper filament voltage. It will also be found that the smaller tube as an oscillator will probably require a slight change in the "B" battery plate voltage for the receiving adjustment. At 160 meters I obtained with the UV-201A oscillator an antenna current of 100 milliamperes, and voice was reported very QSA with excellent clarity eight miles away during daylight. While practically all of the communication with the "Uni-Set" has been with C.W. telegraphy, two or three tests on voice transmission have indicated very satisfactory performance, although, of course, the loop absorption method does not permit of modulating but a small amount of the output energy.

While the "Uni-Set" does not embody quite the facility of the permanently adjusted and separate transmitting and receiving units and is perhaps not quite so efficient, it does possess a simplicity and utility which is appealing, particularly in conjunction with monetary saving. It can be quickly tuned up to any average amateur

For clearer radio, use the contents of these boxes

THESE little boxes contain Na-Ald De Luxe Sockets. If you want clearer radio, use them. You can't have clear radio unless the contact between tubes and sockets is perfect. It's the contact that counts. Na-Ald De Luxe Sockets insure perfect contact at all times because of the special clean-easy feature.

Film of oxide between tubes and socket, better known as corrosion, the arch-enemy of perfect contact, is quickly and easily removed by twisting tubes in the sockets two or three times. This method saves a great deal of time and bother over the former method of removing tubes, reaching down into the socket with sandpaper or knife to clean the contact, then replacing the tube again.

Highest Insulating Qualities

NA-ALD Sockets are genuine Bakelite Alden Processed. This gives a socket of well-cured not-too-heavy Bakelite of even cross-section throughout.

Thus Alden Processed construction insures highest insulating qualities and lowest loss. All possible current is carried from socket clips to tube terminals. This is most essential as current flow is so minute, any loss is noticeable in the efficiency of the results.

You can obtain Na-Ald Sockets at radio electrical and hardware stores. Use them not only in the set you build but also install them in the set you buy, if not already adopted by the manufacturer. Sockets for all tubes. De Luxe 75c; others 35c, 50c, 75c.

Send for free copy of radio booklet—"What to Build."

ALDEN MANUFACTURING COMPANY
Also Makers of the famous Na-Ald Dials
Dept. K4, Springfield, Mass.

FREE BOOKLET—MAIL COUPON

Alden Processed
NA-ALD
Sockets and Dials

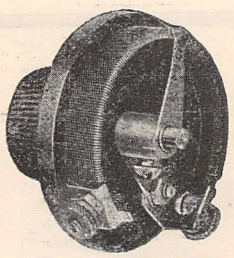
ALDEN MANUFACTURING COMPANY
Dept. K4, Willow Street,
Springfield, Mass.

Please send free copy of booklet "What to Build," showing tested and selected circuits.

Name .....

Address .....

City ..... *State* .....



APPROVED RADIO NEWS LABORATORIES 1925

How Many Ohms?

Many people find it very difficult to choose the correct rheostat ohmage for their tubes. This is because no reliable data has as yet been made available to guide both fan and radio dealer—data that is clear and understandable.

The Klosner Radio Corporation has devoted considerable time to checking up all available data on the subject as well as to conducting independent experiments.

The result is the complete and authoritative

KLOSNER RHEOSTAT CHART

Showing the correct rheostat Ohmage for every use

This chart covers every use to which a rheostat can be put, with all the various types of vacuum tubes in general use. It is invaluable as a source of standard information to every user of a radio set. The dealer will find it indispensible.

Send for this valuable information free, with interesting literature on the Klosner Line of Rheostats—built by pioneers—specialists in radio rheostats—standard with amateurs who know, as well as with leading set manufacturers.

Write today—and please mention your dealer's name.

Klosner Radio Corporation
1022 East 178th Street, New York City

RHEOSTAT (KLOSNER) CHART

The correct Rheostat Ohmage for every use

TYPE OF TUBE	"A" BATTERY	NUMBER OF TUBES	RHEOSTAT TO USE OHMAGE	RHEOSTAT TO USE AMPERAGE	REMARKS
UV 201 A, C 301 A, DV 2	6 VOLTS	1 2 3 to 4 5 to 8	20 OHMS 10 " " 6 " " 5 " "	.75 AMPERE 1 " " 1.5 " " 2.5 " "	
UV 200 C 300	6 VOLTS	1	6 OHMS	1.5 AMPERE	Power Rheostat: Only use if no 1 Rheostat recommended, Parallel, or Various Phasing
UV 199 C 299 DV 3	6 VOLTS	1 or 2 3 or 4 5 or 6 7 or 8	60 OHMS 30 " " 20 " " 10 " "	.25 AMPERE .5 " " .75 " " 1 " "	
	45 or 3 VOLTS	1 or 2 3 or 4 5 or 6 7 or 8	30 " " 20 " " 15 " " 10 " "	.5 " " .75 " " 1 " " 1.5 " "	
WD 11-12 C 11-12	6 VOLTS	1 2 or 4	30 OHMS 15 " "	.5 AMPERE 1 " "	
PEANUT TUBE	45 or 3 VOLTS	10 12 or 4 5 or 6	60 " " 30 " " 15 " "	.25 " " .5 " " 1.5 " "	
	1½ VOLTS	1 or 4	6 " "	2.5 " "	Not more than one Tube to a Rheostat.
SODION	6 VOLTS	1	20 OHMS	.75 AMPERE	
VT 1	6 VOLTS	1	6 OHMS	1.5 AMPERE	Not more than one Tube to a Rheostat.
VT 2	8 VOLTS	1 or 2 1 2	8 OHMS 4 " " 2 " "	1.5 AMPERE 2.5 " " 2.5 " "	Not more than one Tube to a Rheostat.
UV 202 C 302 (Power Tubes)	8 VOLTS	1	2 OHMS	2.5 AMPERE	For more than one Tube use Rheostat recommended.
	6 VOLTS	1	——	——	No Rheostat necessary.
210 X (Power Amplifier)	6 VOLTS	1 or 2	——	——	No Rheostat necessary.
MYERS HI MU	6 VOLTS	1 2 3 or 4	20 OHMS 8 " " 4 " "	.75 AMPERE 1.5 " " 2.5 " "	
MYERS UNIVERSAL	6 VOLTS	1	20 OHMS	.75 AMPERE	Not more than one Tube to a Rheostat.
MYERS DRY BATTERY	3 VOLTS	1 2 3 or 4	30 OHMS 20 " " 10 " "	.5 AMPERE .75 " " 1 " "	

This Chart also applies to other types of Tubes with filament characteristics the same as those listed above

FOR LONG LIFE AND GOOD RECEPTION BURN TUBES LOW AND TURN THEM ON AND OFF SLOWLY

KLOSNER RADIO CORPORATION, New York
RHEOSTAT SPECIALISTS

antenna and adjusted to various transmitting waves. On the receiving side, it is simple to handle, requiring only two controls which are the condenser VC and the potentiometer. During the present winter months the "6" amateurs (Sixth District, Pacific Coast) come in with fairly good audibility on the more favorable nights (this reception being at Pittsfield, Mass.). The change of switches and VC adjustment for shifting from transmitting to receiving, or vice versa, requires about two seconds. When starting to work a station, however, it is best to make a notation of the dial setting of the VC so that on subsequent change-overs after transmission, the "Uni-Set" can be put back to precisely the same receiving adjustment without any exploring.

Aside from its utility for amateur work, the "Uni-Set" might have a possible field of application where compactness and portability are desirable factors, such as in army field work, forest patrol service and aviation. After the writer has had two or three months of experience with the operation of the "Uni-Set," a report of the DX will be submitted including the results of some more extensive voice tests.

I Want to Know

(*Continued from page* 1690)

radio frequency amplification, neutralized, added to a regenerative detector and two-stage audio frequency amplifier set.

"C" is a standard neutralizing capacity.

The three-coil inductance unit is of advanced design. It has been found that much greater amplification could be had if the capacity coupling between the primary and secondary of transformers could be eliminated or reduced.

To that end, a special inductance, called a "regenoformer", was designed. It has a rotor (which may be made by winding 30 turns of No. 24 D.C.C. wire on a 2¼-inch to 2½-inch tube. A hard rubber tube will be best) at one end of the secondary. This secondary may be made in the conventional manner by winding about 50 turns of No. 24 D.C.C. wire on a three-inch tube. At the opposite end of the secondary is the primary. It fits just inside the secondary, at the filament end, and is only two turns wide. In order to transfer sufficient energy from primary to secondary, more inductance is required, so a deep groove, two turns wide, is cut in the insulating disc in which the primary is now wound. For experimentation, try about 15 turns of No. 24 D.C.C. wire as the primary. It may be necessary to change this to as many as 20 turns, or even 25 turns, depending upon the care used in construction.

Resistance "R" may be a Bradleyohm or a Variohm variable between 10,000 and 100,000 ohms.

A filament control jack is used to cut off the filament current of the audio frequency amplifier tubes, when only the detector is being used for reception.

Is Radio Earthbound?

(*Continued from page* 1629)

trical properties of the surrounding gases.

This theory enjoys great vogue among men of high authority. More adventurous minds have hoped that by means of the radio wave we might communicate with other living beings on other planets. What a masterful conception to stimulate the hopes of man! To reach out beyond our own little sphere and find other civilizations will do more to advance human thought and development than all the works of religious founders for all time.

Communication from airplanes and airships between each other and with radio ground stations has given support to the thought that possibly the radio wave is not fettered to earth, and that it might penetrate to interstellar space.

Electromagnetic disturbances caused by mighty eruptions shown in spots on the face of the sun have been noted on the earth and records made from them in radio stations. If such disturbances can project a radio wave from the sun to the earth, then is it not proved that these impulses can carry on through space?

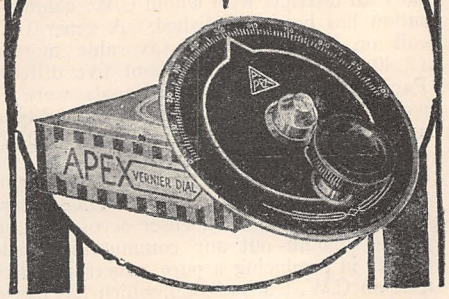
on the dot

It's as easy as placing your pencil point on a town on the map—this tuning in with Apex Vernier Dials.

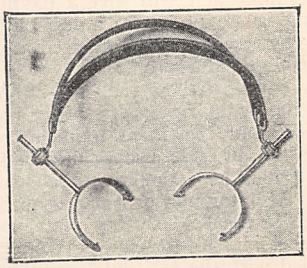
They make logging a simple matter and "getting a station" positive. The ratio is 12 to 1. Sells in Royal Brass Finish for $2.00—Satin Silver Finish $2.50 DeLuxe Gold Plated (24k) $3.50. Applied to any shaft—quickly.

Apex 7-Tube Microdyne—Super-Heterodyne knock-down sets sell for $97.50. The Apex Super Five in a Walnut Cabinet is $95.00. See your better Radio Dealers.

Apex Electric Mfg. Co.
1414 W. 59th St.
CHICAGO
Dept. 306



You Know These HEADBANDS



Simple friction slide adjustment.
Most satisfactory on the market.
No thumb screws to bother with or to catch in the hair.
Two yoke sizes fit any 'phones.
Bands covered in Black or Khaki webbing.
Prompt deliveries on any quantity.

$500,000.00 worth of special and automatic machinery assures quantity output and guaranteed delivery for manufacturers and dealers on any radio equipment.

Submit sample of product. Write for prices.

THE AUTOYRE CO.
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Insure your copy reaching you each month. Subscribe to RADIO NEWS—$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

To obtain exact proof of this perplexing question has been a problem impossible of solution, since we had no way to set up radio waves beyond the earth's zone of influence, until Professor Goddard first brought out his projected Moon-Rocket.

THE MOON-ROCKET

The Moon-Rocket has been discussed in these columns before, and a lengthy discourse about it would be out of place here. Simply the plan is to build a giant rocket which shall move through space by the ejection-reaction principle. It will carry a series of explosive charges sufficiently powerful to drive the body of the rocket beyond the gravitational pull of the earth, the successive charges to drive the rocket to the moon. As the mighty projectile progresses through the heavens, it will be watched by thousands of astronomers who will check on its flight, speed and the place where it lands on the moon. This latter item of course depends upon the accuracy of calculations made for picking the proper time, place and direction of initial flight.

TO INCLUDE RADIO TRANSMITTER

It is now proposed to include in the mechanism of the rocket a small but powerful radio transmitter which shall be set in operation at the moment the rocket is released. Coincident with the verifying of the flight of the rocket by astronomers, the vast army of radio listeners will stand by their receiving sets with watches in hand noting the strength of signals as long as they shall continue.

This will settle once and for all whether or not the radio wave, our only present day hope for signaling other intelligent creatures on other planets, can conquer the void between our interstellar neighbors and ourselves. What a wonderful inspiration it will be to mankind to realize that there exists elsewhere than on earth other living, thinking beings.

Some plans were made for carrying a man as a passenger in the Goddard Rocket, and volunteers were even listed for the journey. Such a human sacrifice has been discouraged, for there is little doubt but that a man thus carried could not survive the trip for many reasons. It is also believed that the first tremendous impulse of the rocket in flight would be great enough to burst the blood vessels of the passenger, therefore the idea of the passenger has been abandoned.

In lieu thereof, the radio transmitter has been suggested as a passenger. It will certainly provide intelligent means for obtaining important facts about the vast spaces existing throughout the universe.

When the world of science knows for a certainty that the radio waves can carry through interstellar space, the time when further and more ambitious attempts to communicate with our planetary neighbors will be hastened.

This may answer the cynical queries of skeptics who demand to know what use all this sort of thing is to the world. Every new scientific fact produced supplies further tools with which to better our fast growing and complicated structure of civilization. Let it be hoped that success crowns the efforts of all men who dare to pioneer the distant fields of our universe.

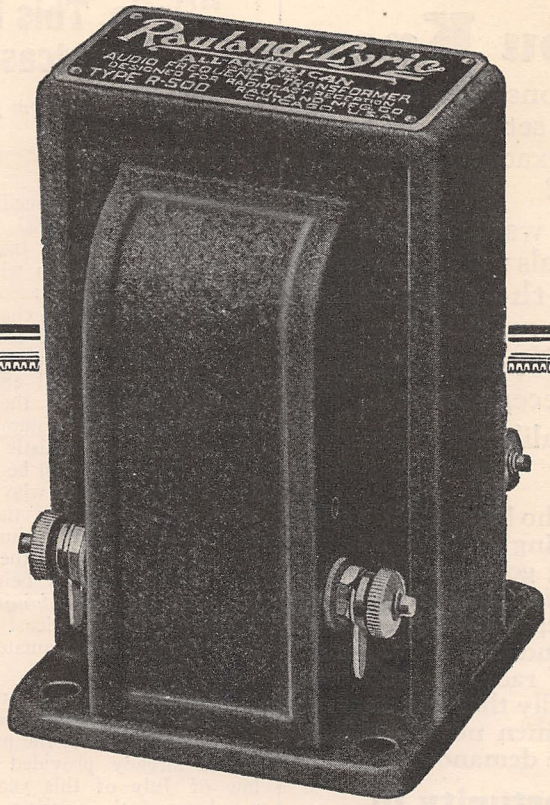
'TIS AN ILL WIND THAT BLOWS NO GOOD

Lawyer: "We've a strong case against the Hectic Transformer Company."

Client: "Why is that?"

Lawyer: "In the radio trial, the judge's receiver greatly distorted the facts."

Contributed by Jack Bront.



Tonal Beauty Lies Deeper than the Varnish

DEEPER even than the circuit diagram—chiefly, indeed, in the *audio transformer.*

All-American engineers, builders for years of the *largest selling transformers in the world*, have achieved another triumph, in the *world's finest transformer* at any price. *Rauland-Lyric amplification*, with an ordinary tuner and loudspeaker, has received the plaudits of musical authorities hitherto skeptical of all radio reproduction.

Perfect amplification makes of radio a joy unending. Who shall say that such a benefit is not worth the slight additional cost?

There is romance in the story of Rauland-Lyric. A request will bring it to you complete — from the laboratory studies to the auditions with world-famous music critics. Rauland Manufacturing Company, 2646 Coyne Street, Chicago.

The price is nine dollars

Rauland-Lyric

AN

ALL-AMERICAN

TRADE MARK

TRANSFORMER

The Choice of Noted Music Critics

Do You Know

—how to construct a radio receiving set scientifically and the exact function of each part?

—how the wave length of radio signals may be measured by the maximum amplitude method?

—the Heterodyne principle of radio reception?

—how to calibrate a receiving set?

The men who have a thorough understanding of these things are holding good positions in the radio industry today as designers, repairmen, salesmen, engineers and executives. And the field of radio is broadening so rapidly that the supply of trained men never catches up with the demand.

Opportunity In Radio For You

Prepare now for a big future in radio. Even though you may be employed at present—study radio at home in spare time. The Radio Institute of America, the world's oldest radio school, now offers a new, revised Home Study Course that covers every phase of modern radio.

Radiola III Free With Course

A Radiola III complete with two tubes and headset is only one of the four pieces of highest grade apparatus furnished free with the course. 7,000 Radio Institute graduates have secured radio positions. With Radio Institute training, you, too, can enter the ranks of this highly paid profession. Mail the coupon today for more information.

Radio Institute of America
(formerly Marconi Institute)
Established in 1909

324 Broadway New York City

CUT HERE

Radio Institute of America
324 Broadway, New York City

Please send me full information about your Home Study Course of radio instruction.

☐ I am interested in the complete course including code instruction.

☐ I am interested in the technical course without code instruction.

Name .....

Address .....

.....

"Hello, This is Vienna Broadcasting"

(Continued from page 1634)

Vienna and its immediate surroundings. Special taxes of 3,000 to 22,000 kroners apply to temporary or traveling installations of radio apparatus, in which special regard is given to amateur associations and institutions of an official character, which also fall into the class of lower monthly dues. Now this kind of announcement has a certain social and moral effect which finds a powerful support in the logical point of view, that with the number of subscribers the technical and artistic developments will grow. The truth must be spoken: The number of illegal hearers who wish to save themselves the payment of the taxes, according to the last official estimate, is more than double the number of the enroll d subscribers. Means are now being sought to compete with the class of injurious parasites on behalf of the broadcast company as well as of the honorable amateurs, without using radical means.

In addition to the organization of the Austrian radio, development is now in contemplation, which is the proposed radio committee already provided for in the radio law of July of this year. It consists of members of the various organizations such as Chambers of Commerce, Workmen's and Farmers' Associations, Amateur Organizations, representatives of the radio industries and congress, proprietors of real estate and the like, so that a good equilibrium of interests is given, that will have charge of the development of the radio industry in an intelligent and regular manner; especially has the good influence of the Committee shown itself in the working out of the distribution of taxes and the administration of the radio law, which might have had many disagreeable features for the amateur. What it has principally brought out in its sittings, which certainly corresponds to the wishes of all, is to avoid the failing in its artistic lines, as it should in every way cultivate music and art, which now are the principal functions of broadcasting. But as it is now, the artistic direction of the broadcast station does its best to eliminate failures in this regard.

THE VIENNA RADIO STATION

And now a few words are to be said on the general features of the broadcasting plant. It has been installed in the center of Vienna in the Ministry of War Building, the construction of whose antenna and sending apparatus at one time occasioned the authorities great difficulty. It was only after a radical rebuilding that adequate transmission was made possible, when all the experiences hitherto recorded in broadcasting were used to produce a station of the very first class. The antenna is 48 meters (about 156 feet) above the roof, giving a total altitude of 71½ meters (about 230 feet). Compared to the first outfit, the one now in use had to be raised 10 meters higher (about 32 feet) to give a better distribution of the 530 meter waves. The plans show the arrangement of the new station, which required five rooms for its installation; the soul of the transmitter is a modern 1.5 kilowatt vacuum tube of the Telefunken firm of Berlin, connected in feed-back coupling, whose undamped waves of the antenna circuit and connections are modulated by a microphone, into the direct current grid current. A dynamo gives the necessary direct current of 4,000 volts for the plate of the

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Loud Speaker Unit

$5.00

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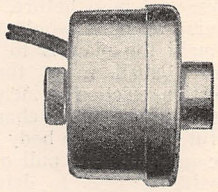

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transmitting tube, while in the battery chamber the filament current of 16 amperes, along with 3½ amperes for the sending and telephone connections are given. The modulation of the high frequency waves is based on the principle of the coupling-in of a variable ohmic resistance between grid and plate of the sending tube, which performs the function of a repeater tube. The resistance of the repeater tube is changed by the secondary circuit of a transformer connected to the grid of the tube. The primary winding of the transformer is traversed by the modulating or talking current of the microphone circuit. The so-called Siemens ribbon microphone is used, the most perfect produced up to date. Between the poles of a powerful electromagnet there is placed a corrugated aluminum ribbon a few thousands of a millimeter thick, 4 millimeters (.16 inch) wide, the tension of which is so slight that it has hardly any individual period. It is protected from mechanical disturbance by proper supports or cushioning, so that in a silent atmosphere it is absolutely quiet. The sound waves, due to speech or music, induce alternating currents, which after adequate intensification give an absolutely clear reproduction of the sound, free from all disturbances. It would be very desirable undoubtedly if smaller transmitters as relay stations were erected in the Provinces, first in Gratz, Styria, and then in Innsbruck in the Tyrol.

CHARACTER OF PROGRAMS

The transmitting program of the Radio Vienna station includes the usual offerings of the European stations operating daily, although scientific, political and religious lectures have not yet been taken up. In music and art outside of its international scope, the specific Austrian note prevails. Vienna claims to be in itself a leading city in these regions of culture. It knows how to preserve its honorable standing, although it is not lacking in the effort to get its fame in this direction everywhere acknowledged. Accordingly, for the presentations of the Vienna broadcasting, the motto holds, *Noblesse Oblige*. This must be adhered to, so that the fame of Vienna as a musical city will be fortified and strengthened and its radio broadcasting will become a mighty competitor in the peaceful competitions of the nations. It must be acknowledged that the directors of the transmitting station take great pains in being true to their high office. It follows from this that the Vienna population by their traditional inheritance is devoted to music and accordingly will expect from their transmitting stations only the best performances.

AUSTRIAN RADIO INDUSTRY

In conclusion, a few words may be given to the Austrian radio industry. In spite of difficult economic and even geographic relationships which apply to the building of apparatus, the Austrian constructors have been able to bring very high grade products upon the market, which can sustain the sharpest criticism of the technicians of advanced radio. Naturally, for us as well as for most European countries, the United States figures as the fatherland of radio broadcasting, and it serves as the gauge for the perfection of the work.

The Insurrecto Hook-up

(*Continued from page* 1664)

mighty efficient. Each loud speaker had a small crystal receiver hooked onto it, each set on a different wave-length. Well, sir, I put those loud speakers at various points 'bout the place, and explained it to the hens. In them days we didn't have no radiophones,

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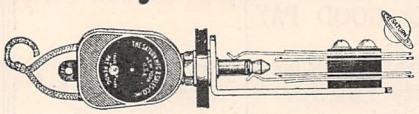

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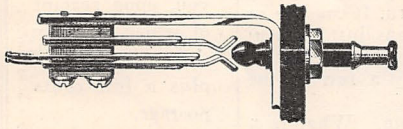

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so I taught the chickens to come by usin' the code. Really, it's plumb surprisin' what a chicken can learn if it only puts its mind onto it. Well, inside o' six months I had three thousand hens that could read International code like a sea-goin' op. Oh, it 'uz a purty sight, seein' 'em all comin' in at the call o' the loud speakers. I used to have different calls for different things; for example, there 'uz a hollow in a little valley near one o' the speakers that used to be a popular resort for the middle-aged hens 'long 'bout four o'clock in the afternoon. Well, sir, the roosters found it out and plumb pestered the life out o' them hens. Finally they complained. So I organized a drill squad, and made it compulsory for every rooster o' legal age to belong to the Home Guard. Then, 'bout four o'clock, I'd tap out the assembly call, and the roosters 'ud have to come chasin' in, leavin' the hens be. Then there 'uz other advantages. Why, I used to be able to get all the hens in at once by sendin' the CLE call."

"CLE call?" repeats Doris, my side-kick.

"Come Lay Aigs," explains Sam. "Yes, sir, when the CLE call sounded Mrs. Plymouth Rock 'ud drop a worm and run in and hop on the nest. Used to save me a heap o' trouble huntin' for aigs. I stood to make a fortune."

"Then what happened?" I asked breathlessly.

"Seduction," replies Sam laconically.

"Seduction?" repeats the very dumb dora.

"Exactly. You see, after a few months I began missin' hens. A dozen or so a day failed to punch the time clock. Then it kept gettin' worse and worse. Most o' the losses seemed to come from the social leaders in the hollow I mentioned awhile back. So I got curious and hid myself over near the place. Pretty soon I heard a tappin' comin' from the loud speaker. 'GRS' it said, which 'uz my standard call meanin' 'Gather 'Round Speaker,' a sort o' general attention signal. Well, the hens naturally ran up to the speaker. Suddenly there 'uz a commotion, and the hens scattered. I knew nobody else but me could handle the radio, so I sort o' suspected trouble."

"I know what it was," I offers. "Interference."

Sam shoots a jawful of brown liquid over the porch rail. "Son, you're right, only you ain't," he explains. "When I got over by the speaker I saw the last o' one o' my pet hens being barbecued by about three score rattlesnakes. Sittin' on top o' a rock 'uz a big he-rattler, a tappin' off Continental Code as slick as a whistle. He saw me and sent out a SOS, and every snake took a dive into a hole. It takes a long time to learn a hen anything, but it takes a heap longer to unlearn him. I couldn't get rid o' the snakes, so I had to quit the game. Too bad."

"Yes, wasn't it?" I agrees.

"Turrible," concurs the sourdough, hydraulicing another jet of the brown liquid into the alkali.

I gives a yawn. "C'mon, my dear," I says, "we'll have to sleep that one off."

Just to get us acquainted, my family Bible name is Joseph Hammerstein, and the set of ruffles is Doris, my one and only—thank God! We're actors; to be specific, dancers in vaudeville. Playing east, we're confronted with a sudden two weeks' layoff, due to a couple houses closing, and finds time heavy on our hands. The rest of the act goes on to Denver, but we takes a run down into Arizona to the DX ranch, about five miles from the border. The said cactus plantation is piloted by an old buddy of mine that got gassed in the big conflict and had to get sand in his breathers to keep his throttle from slipping. George Wilson's his name. It's all very sweet and pretty.

It's Tuesday morning, and we're up early, by necessity, since they ain't got no quick

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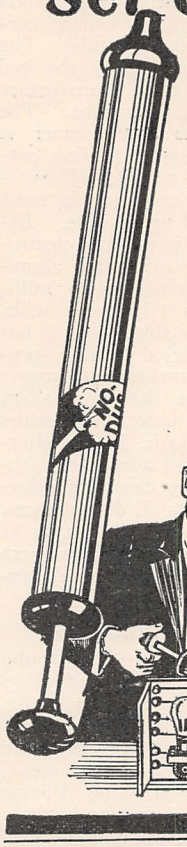

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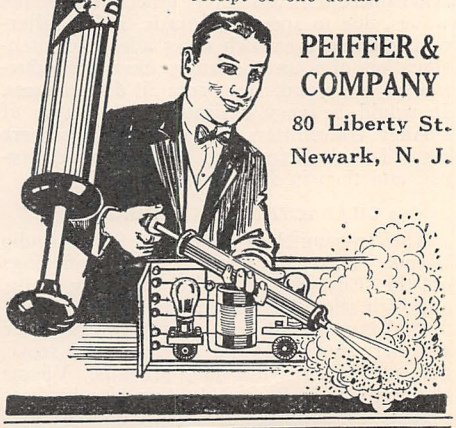

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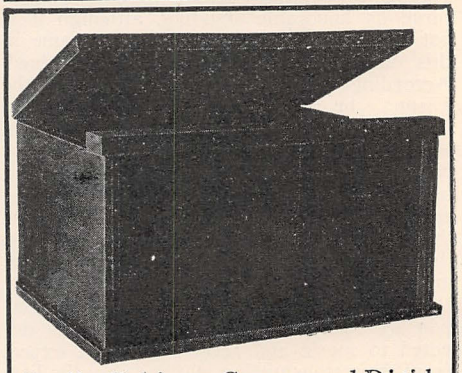

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lunches in the desert—either you eat with the gang or you kid your appetite for another six hours. After a meal of biscuits and salt pork we takes a stroll out onto what should be a front lawn only the grass ain't been told about it. The place looks forlorn to me, though Doris says the air is filled with the very essence of romance. When I replies that all I can find in the air is sand, she hands me one of those I'll-let-you-live-just-once-more smiles, so I signs off. I'm an Easterner, and may be prejudiced, but as far as I can see the only reason they calls it God's country is because nobody else wants it.

Well, things moves slower than a crippled mule team pulling a Pennsylvania locomotive up the Hudson River, and I gets sorta lonesome. Doris is learning to ride a horse, but I don't need to reduce, so I stays inside and putters with what George says is a radio. After three hours' labor I gets Tucson. I sees where we're due for a dead time until the ranch foreman perambulates into the setting.

"Dommy called last night at the CW," he drawls to George. "Got a hundred head."

"The devil!" grunts George. "Anyone hurt this time?"

"Old Harry McPherson got a pill in the arm," said the foreman. "Rather tame affair. Dommy wasn't at his best."

"Who's Dommy?" I asks.

"Mex friend of our'n," replies the foreman. "Real charitable chap, too. Very socialistic."

It passes over us, so George explains. "He means Dominguez, the bandit."

"Dominguez!" I yelps. "Not the famous rebel that's been headlining for the Associated Press?"

"Identical."

"Why——"

"Oh, yes, he raids over here every so often. Hasn't bothered me yet because I've not much of a herd. Don't worry."

When a fellow advises you not to worry about something you didn't know you should worry about, it disturbs the peace.

"Is this Dommy very bad?" I asks.

"Oh, no," drawls the foreman. "Quite affable. Likes cattle, but prefers women."

He makes this last crack while looking at the wife out of the corner of his eye. It dawns on me—if Dominguez hears that there's a woman at the DX he'll be sure to make a raid. Added to that, the frau is a fairly recent graduate from Ziegfeld, with honors, and I don't feel so good. However, I keeps silent about it.

That afternoon I charters a mule from Sam and lopes into what the natives insist is a town, and me, being a stranger, having to take their word for it. At the railway station I sends a wire to Los Angeles. Then I turns the mule about face and ambles back to the ranch.

About four-thirty the next afternoon one of the cow gents sights an aeroplane. I calls to Doris.

"He's coming," I informs.

"Who is?" asks the legal restraint.

"The Master," I says.

"Why—how does he know where we are?" I explains. "I wired him. You see, we're kinda lonesome down here away from the asbestos, and I happened to remember hearing Jerry say he wanted to make a few desert radio tests of some sort, so I told him where we were and asked him to fly over. He's here."

The plane mows down a coupla infant cactuses and comes to a stop. Out hops a tall, dark-haired, shell-rimmed individual, hampered by a lot of packages and boxes.

On the membership roll of the First Presbyterian Church of Brightmere-on-the-Deep, Long Island, he's listed as Gerard Algernon Lawson, but his servants, of which he has an unlimited supply, calls him The Master,

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Sooner or later you'll settle all the other questions and reach the last one—*which battery charger to buy*. There are several good chargers, each worthy in its own way. Selecting one of them is just a matter of which features you want in the charger you seek.

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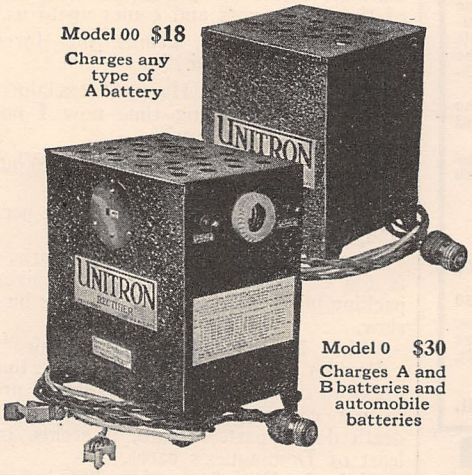

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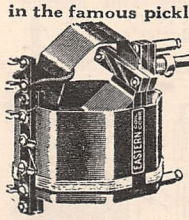

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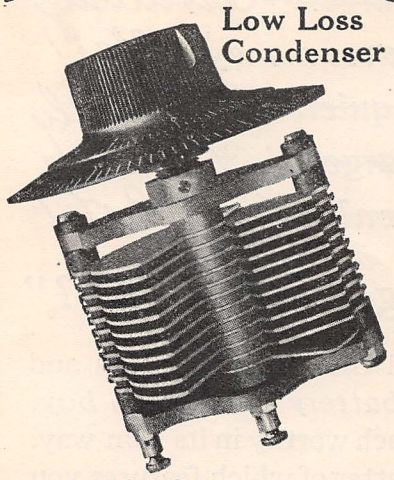

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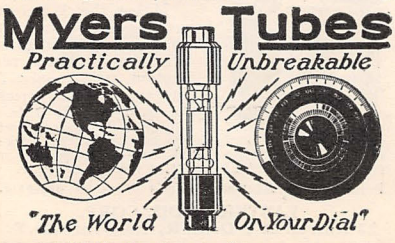


"The World On Your Dial"

Write for descriptive circular

which is a polite way of referring to the gink that John Hancocks the weekly stipend voucher. Jerry sees us and comes running over.

"Hello, folks," he greets. "I received your wire, Joe, and came right over."

Well, to censor the monotonous details, by Thursday noon The Master and I has fixed up a temporary laboratory in an abandoned 'dobe hen coop. A laboratory is as essential to Jerry as ham is to eggs, or eggs is to ham. The Master is experimenting with short wave transmission on dry, hot air, and he's got the biggest and best supply of the latter I ever wafted outside of the hall of Congress. The days are so hot you envys Dante in his little Inferno, and the nights make a polar expedition look like a midnight crusade on the family icebox. However, there's a couple hours in between when it's real pleasant to sit on the front porch and broadcast, which we does, the gang gathering around to hear Sagebrush Sam tell of the time he made a regenerative set out of a powder puff, six stove bolts and a tomato can.

On this particular evening The Master takes issue with Sam on the question whether ether waves oscillate up and down or back and forth, and we're all having a quiet laugh. Finally Jerry, whose sense of humor is limited to jokes of the Boston parlor variety, says he'll prove something or other and goes out to the laboratory to arrange some sort of evidence. We're all amusing ourselves innocent enough when bing!—the porch light goes out!

The foreman makes a sally for his hip, but another lead plaything nicks his palm and changes his fortune. Out of the semi-darkness looms a band of horsemen. One of them dismounts and comes up to us.

"Hello, Dommy," grunts the foreman. "Can'tcha take a joke?"

"Weel, my fren' Happy!" exclaims the newcomer. "For long time now I no see you. Did I shoot you?"

"You did," grumbles Happy. "What do you want here? Cattle?"

The Mexican gives us all the close perusal. "Oh, maybe, mabye not."

Then His Rebel Slyness sees Doris, who is too scared to hide behind a convenient packing box. I says for Dominguez he ain't slow.

"Ah! Ze beautiful ladee! Come!"

Bandits ain't exactly in my line, that is, Mexican ones, and I offers righteous protest in my capacity as family provider until death do us part. Death, it seems, is the least of Dominguez's cares.

"A husban'?" he remarks. "Such foolishness."

As it happens, Sagebrush Sam is the only one besides ourselves who hasn't met up with Dommy on some previous occasion. Not knowing the general's little odd ideas, Sam tells our friend where to go in three short words.

"You! You fat monkey!" snorts Dominguez. "She no come, I take her."

"Joe!" wails Doris. "Joe, don't let him take me from you!"

The general laughs. "I no take you from heem. I take heem, and that fat monkey along weeth us, so! You I love, the husban' I keel after while, and the fat monkey I make work!"

He signals his gang and a dozen of 'em comes up. We're taken out and tied, not to horses, but in one of the original flivvers—at least a 1910 model, brass radiator, half-wheel brakes, and all. A greasy gent chauffeurs us out into the night.

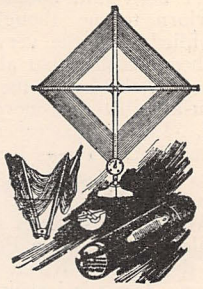
Sam chews in silence, and Doris weeps. I ain't exactly enthused over playing Benedict Arnold in front of a bunch of hardened Mexican firstnighters. Not even for a benefit performance.

Hardly more than ten miles into Mexico

Reg. U.S. Pat. Office

Lincoln

RADIO PRODUCTS



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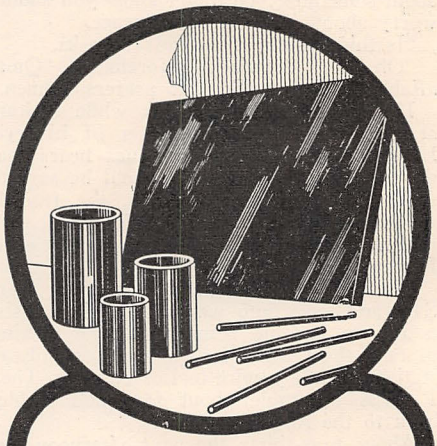

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the caravan halts. Somebody has brought news to Dominguez, and he calls us at ease. We're on a wide plateau, level except for a small hill at one end near us. The rebels runs the flivver up on top of this knoll, unties us and places a guard at the base of the hill. I'm anxious to have it all over with and asks a guard when the show opens. I'm told that Dominguez is busy elsewhere, doing a little relief raiding for a pal, or working out a crossword puzzle; anyways, he isn't present. So we three are left all alone. Escape for the moment is out of the question. Doris continues to weep.

"J-Joe," she sobs, "what'll we do?"

"Never mind, honey," I soothes. "Little Joe'll come through."

"What c-can we d-do?" quavers Doris.

Our spirits is going down, so I tries to clown a bit. "Well," I says, "we could radio The Master to come in his plane, if we had a radio."

The wife is too scared to bawl me out, but Sagebrush Sam steps in with a crack.

"Why not?"

"Why not what?"

"Why not build a radio?"

Even with goose pimples I gives a snort. "What with?"

"Reminds me o' the time I built a transmitter——"

"Oh, can it!" I commands. "Be serious."

Sam means it. "I am serious. Le's build a radio."

"As I said before, what with?" I comes back peevishly. "I don't see no five and dime store handy."

"Nature," remarks Sam, "gives all—supplies all. We have but to look around us for what we want."

Even with death staring me in the face I concedes him his laugh. "All right," I agrees, "let's build a radio—whee!"

"You're so plumb ornery I oughtn't to tell you," states Sam, "but I will. We're going to build a radio."

With this he drops to his knees and crawls over to the flivver. In a few minutes he comes back with something in his hand. To my surprise, it's a spark coil. Then I remembers these antique flivvers came in before the self-starter era and carries induction coils for ignition. The possibilities begins to open up, and for a minute I almost thinks Sam is entirely sane.

"Score one," I admits. "You've gotta coil. Now get some juice."

"Sure," drawls Sam. "These relics use dry cells. Here we be."

"Next we needs a key," I says, getting into the spirit of the thing. "A coupla strips of tin will serve. We've gotta lot of tin."

I makes a doubtful key in this manner and Sam gives it his approval.

"Now we oughta have a condenser," says Sam. "Got any tinfoil?"

"Right here," I says, digging outa my pocket half a dozen empty cigarette packages. "Here's your con."

Sam folds it out smooth. "Got any waxed paper about you?"

Doris makes her entrance. "I saved this from those sandwiches we had on the train," she says, handing us a large sheet of the desired substance.

"Lady, I bows to you," I says. "For the first time in your life, you've saved something useful. I'll bet it was an accident, at that."

The wife ignores me, which proves she's getting back to sub-normal. Sam makes his condenser—capacity undetermined—and then looks up.

"Need a spark gap," he states.

"Two seven-penny nails and a block of wood," I prescribes.

"Have no nails, can't hammer," says Sam, cryptically.

We fumbles about for a few minutes, finally contriving a space for the juice to

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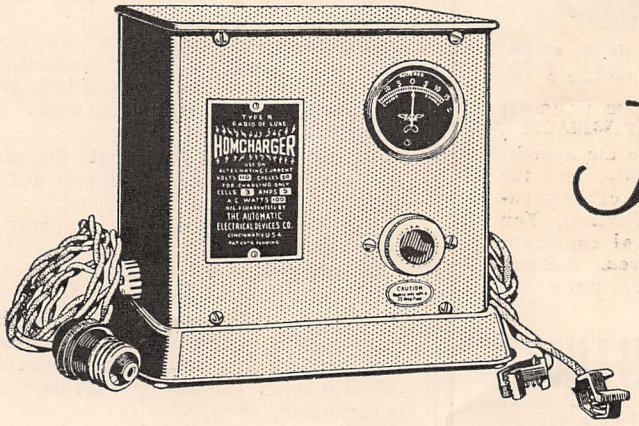

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parachute over by hooking a wire to one of the spokes in a wheel and letting the current hop to the tire valve from a tin plate on the spoke.

We gets it all connected without drawing the attention of the garlic guards, but the aerial, a bit of a necessity, puzzles us. In the first place, we can't get it strung without attracting the rebels' notice, and in the second place, we ain't got no aerial in the first place.

"You're stumped, Sam," I declares.

"Nope, I ain't," he comes back. "This is simple. Why, I remember the time I built——"

"Sign off, I advises. "What's the idee?"

Sam heaves a sigh. "Such a cantankerous tenderfoot I never saw! Take a look about you. We're pretty high up, ain't we?"

"Yeh."

"All we've got to do is tack the aerial wire onto the tin body o' the flivver and the tires'll insulate it from the ground."

"Sometimes," I concedes, "you almost got sense."

"O' course I have," replies Sam, pained. "Why, once back in Yuma——"

"——you made a tuning coil outa a whisk broom and a razorback hog," I finishes. "Come on, let's do a little wrist calesthenics."

"I only hopes The Master ain't neglecting his researches," I says.

We hits the so-called key and after a time gets a fair spark jumping across the gap. Sam evolves a windmill idea to make a rotary gap outa things, but I'm too practical. So we keeps on sending SOS, with Sam supplying the necessary information as to our location.

"Don't worry," advises Sam. "All that gent neglects is his sense o' humor."

We keeps up the tapping until near dawn, when the battery gives out. Then Doris wakes up. Daylight lessens her sense of fear.

"Where's our little abductor?" she inquires.

"I don't know."

"Didja get anybody?" continues the better or worse.

"How do we know?" I fires back. "We ain't got no receiver. I've been tapping so many SOS's I've got the Continental blues."

There's a commotion down in camp and we discovers that the big boy has returned. He don't delay long, but comes up the hill to our jail.

"Ah, ze fair ladee!" he smiles, all teeth. "Many miles have I ride for one sweet kees, no?"

Suddenly, from nowhere in particular, a fusilade of shots passes over us. Before any of the rebels can grab a gun an aeroplane with a machine gun has landed in the camp. It's The Master and George.

Dommy's surprise is complete. This little rendezvous of his is supposed to be a secret, and he lets off a volley of Spanish cusswords that'd make a sailor's parrot refuse the nomination. Eventually he calms down—by machine gun persuasion.

"But, by gar, how you find us?" he demands.

I explains, and shows him our radio set.

"*Carramba!* A radio!"

"Ain't nothin' else except."

Dominguez turns to us. "Why for the hell you no tell me?" he exclaims. "For long time now I want capture a radio ham."

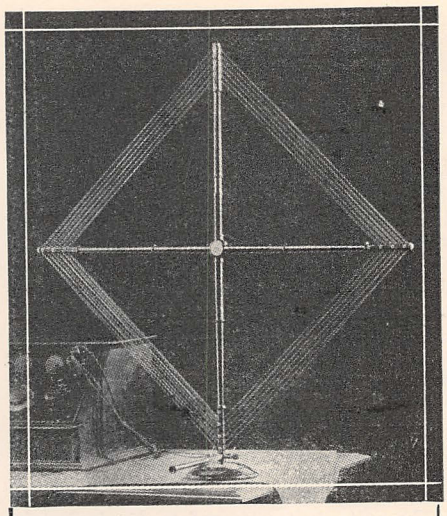
"Why?"

"My seex-tube set get nothink but static. I hook heem up all ways but she no work no more."

"You've gotta radio?"

"Sure! For why you theenk bandit no keep up with times? Every night I used hear Denver, Pittsburgh, Kokomo, all beeg towns. Very int'resting."

I can't help but grin. "Jerry," I calls, "fix this bozo's outfit, will you?"



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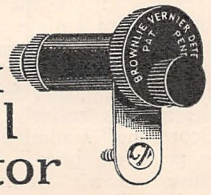

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Jerry goes into the Mexican's tent. Pretty soon he and Dominguez comes out, arm in arm.

"My fren'," states Dommy, "you be sure remember send me grid leaks and two variable condensers, yes? I send you much money."

"Yes."

"My fren'," repeats the Mexican, "in three minute he feex theeng that take me, Dominguez, three month to no do. My fren'!"

Then he comes up to Sam and me.

"I very sorry I breeng you discomfort," he apologizes. "Any man who make radio sets is fren' of Dominguez. Who make heem?"

"Not me," I admits. "Sam did it."

"What!" yelps Dommy. "The fat monkey! *Diablo!*"

I snickers. "Remember your word," I says. "Shake hands."

Dommy and Sam sorta looks into each others eyes and grins. Then they shakes hands and has a good laugh.

"All right, we fren's," says the general. "But, take a teep. Nevair tell Mexican gentleman go to hell. He no like it."

"Strange."

There's a moment's pause. Then Dominguez speaks again.

"I not only release you, but I geev you one grand escort to border. That's me, Dominguez!"

And he does.

"We're half way home from the border when Sagebrush Sam speaks.

"Reminds me o' the time I built a crystal set out o' piano wire and dynamite."

I reaches for a rock. "What happened?" I coaxes.

"It didn't work," says Sam sadly.

Ain't it a pity?

ANSWER TO THE CROSS-WORD PUZZLE PUBLISHED IN THE FEBRUARY ISSUE OF RADIO NEWS

M	O	T	O	R		C	A	R	B	I	D	E		G	A	S	E	S
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T	U	N	E	R		A	E	R	I	A	L	S		W	A	T	T	S

"It's time to talk of many things—"

(*Continued from page* 1674)

of a different stripe, quite a different stripe. It sounded something like this: ..— ..— ..— —.—..— — —..— and so on. Try and read it. Sounded exactly like a J ship trying to get its congratulations to the great and noble prime secretary to the president of the Amalgamated Street Cleaners Association.

Why couldn't the fellow have sent his own call with the clarity used in the call of the station he was trying to raise? Ah, me, 'tis a deep secret.

And, incidentally, the raised station, when

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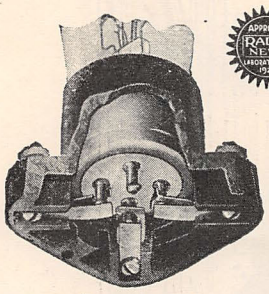

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17 Plate	$2.50
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Pioneers in Tested Crystals

he answered, had to QRA him three times. FB, yeh!

AND the big-headed bug babies. Boy, they sling it at you as if they were a couple of district managers out on an inspection tour. And nine-tenths of the time they make a slip now and then, even as you and I, with the result that they do not hear their own stuff so plainly. The particular reason why I should like to crepe the doors of a few of these buzzards is that they will always come back with a condescending sentence before and after your bk?. They never fail. It's most agonizing, me bucks, most agonizing.

And who will be the first to furnish a new book with formulae for conversations on phone. "Hello, old man, how are you getting me there? Fine business, ha, ha. Now, one, two, three, four, five.. . . . . Come in OM." UGH!

And the OM artist. Why, oh, why should it be necessary to put in an OM at the end of every five-word sentence and inject hi's at the end of a semi-bright crack?

From all such may the good Lord deliver us.

Jay Hollander.

REVISED REGULATIONS GOVERNING THE OPERATION OF AMATEUR STATIONS.

WAVE-LENGTHS

One hundred fifty to 200 meters, 75 to 85.7 meters, 37.5 to 42.8 meters, 18.7 to 21.4 meters and 4.69 to 5.35 meters are allocated to amateur stations.

SPARK TRANSMITTERS

Amateur spark transmitters produce considerable interference and, consequently, are responsible for many complaints. Amateur owners of such transmitters should abandon their use as early as possible and adopt a system producing less interference. Until such change is made they will be permitted in the wave-length band between 170 and 180 meters and should have a decrement not exceeding .1.

PHONE AND I.C.W. TRANSMITTERS

Phone and I.C.W. (Interrupted Continuous Wave) transmitters will be permitted in the band from 170 and 180 meters. I.C.W. shall be defined as the type of wave produced by mechanically interrupting one or more of the radio frequency circuits or the type of wave produced by any transmitting set which produces an equivalent effect.

C.W. TRANSMITTERS

C.W. (Continuous Wave) transmitters will be permitted in all of the bands allocated for amateur use.

COUPLED CIRCUITS

Amateur stations must use circuits loosely coupled to the radiating system, or devices that will produce equivalent effects to minimize key impacts, harmonics and plate supply modulations, except in cases where loops are used as radiators. Conductive coupling, even though loose, will not be permitted.

POWER SUPPLY

No restrictions will be imposed relative to the character of power supply, provided the emitted wave is sharply defined.

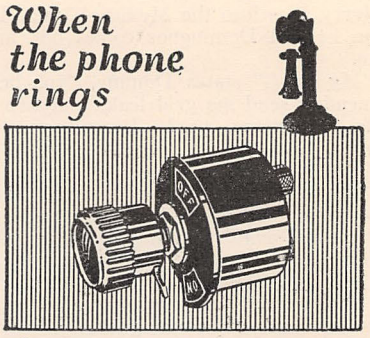
QUIET HOURS

Amateur stations, when using wave-lengths between 150 and 200 meters, are required to observe a silent period from 8 to 10:30 p.m. daily, standard time, and on Sundays while church services are being broadcast. Such stations, when using wave-lengths below 85 meters and having a pure continuous wave, or where a full wave rectification is employed, are not required to observe a silent period, provided no interference is caused.

STATION LICENSES

Licenses issued for amateur stations will

When the phone rings



Snap ~ AND ALL IS SILENT *Snap again* ~ AND THE PROGRAM CONTINUES ~ *without retuning*

No modern set lacks the convenience of a MAR-CO filament battery throw switch. Its definite on and off positions make it far superior to any pull switch. Saves tubes and batteries—you don't forget to turn them off! Saves annoying interruptions when you only want to stop reception for a minute!

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authorize the use of any or all of the wave-lengths allocated for amateur use, provided the transmitter meets the requirements of the above regulations. No alteration in the apparatus will be permitted which results in changing the character of the emitted wave except under authority granted by the Supervisor of Radio.

INTERCOMMUNICATION

Amateur stations are not permitted to communicate with commercial or government stations unless authorized by the Secretary of Commerce, except in an emergency or for testing purposes. This restriction does not apply to communication with small pleasure craft, such as yachts and motor boats, which may have difficulty in establishing communication with commercial or government stations.

SPECIAL AMATEUR STATION LICENSES

There being no further need for special amateur station licenses, owners of stations holding such licenses will be permitted to continue the use of their "Z" calls under regular amateur station licenses. No new "Z" calls will be issued.

The privilege of using the wave-lengths from 105 to 110 meters is withdrawn.

(Signed) A. J. TYRER,
Acting Commissioner.

NEW QRA'S

8BYT—(Re-assigned) H. L. Crumvine, 167 N. Lyman St., Wadsworth, Ohio. 5 watts C.W. and phone. All crds answd.

8CPY-8DKC—Jas. A. Wilson, 911 Lay Blvd., Kalamazoo, Mich.

6BBV—J. Barsby, 1511½ N. Commonwealth, Hollywood, Calif. 100 watts C.W. on 40 and 80 meters. Pse QSL.

6BCH—Vernon L. Harvey, 1140 So. San Joaquin St., Stockton, Calif.

1AMU—(Re-assigned) Franklin B. Rowell, 106 Cedar St., Pawtucket, R. I. 5 watts C.W. on 40, 43, 75 and 80.6 meters. All crds answd.

1AHJ—Pawtucket High School, Pawtucket, R. I. (op. F. B. Rowell). 5 watts on 75, 80.6, 150 and 200 meters. All crds answd.

3CJ—(Re-assigned) M. F. Marx, Jr., 1427 Patterson Park Ave., Baltimore, Md.

6CM—San Diego High School, San Diego, Calif. 100 watts C.W. Pse QSL.

3AGF—Robert W. Elmer, 230 E. Commerce St., Bridgeton, N. J.

NOTICE

4XE, William J. Lee, Winter Park, Fla., is ready and glad to work along experimental lines with any other short wave stations that desire to conduct experiments on any waves down to 4 meters. 4XE is QSO, New Zealand, Australia, Cuba, Porto Rico, Canada, Continental stations and all U. S. districts. A wave of 81 meters is used for night DX and 41.5 meters for daylite transmission (two transmitters).

Calls Heard

6QB, L. H. THOMAS, 33 HARPENDEN RD., LONDON, S. E. 27, ENGLAND

U. S. A.—1aac, 1aal, 1abf, 1agh, 1aj, 1aja, 1ajg, 1ajp, 1ajx, 1akl, 1alj, 1am, 1ana, 1anc, 1are, 1asa, 1atj, 1aur, 1aw, 1aww, 1azm, 1bal, 1bcf, 1bcn, 1bdi, 1bdt, 1bgq, 1bhi, 1bhm, 1bi, 1bkq, 1bma, 1bsd, 1bkr, 1bvl, 1cab, 1ccx, 1ck, 1ckd, 1ckp, 1dq, 1er, 1fd, 1gv, 1hk, 1hn, 1jv, 1kc, 1lw, 1ml, 1mo, 1my, 1ow, 1pl, 1py, 1rd, 1se, 1sf, 1sw,

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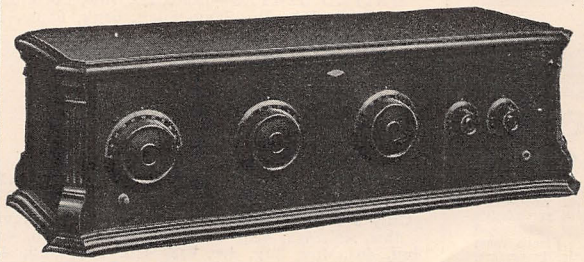
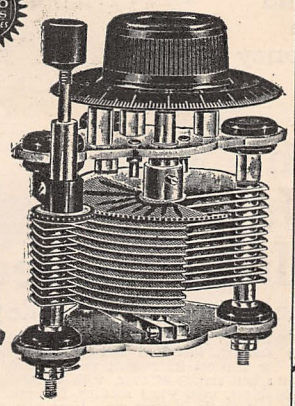
Contributing to the Popularity of the SPLITDORF Receiver



Grounded Metal End Plates



HEATH Condensers play an important part in the accuracy, easy tuning and range of this remarkable *Splitdorf Receiver*. The choice by such an eminent manufacturer of *Heath Condensers* is convincing evidence of thorough-going quality of both materials and workmanship and also of superior design. This sort of evidence is your best guide in the choice of condensers.

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		With Dial	Without Dial
No. 12AV	12 Plate	$5.00	$4.35
No. 24AV	24 Plate	5.50	4.85
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Non-Vernier types in all capacities

Heath Sockets with the Exclusive Shock Absorber Feature. **Price 75c.**
Heath Genuine Bakelite Dials in 2, 3 and 4 inch sizes.
See the Heath Condenser at your dealer's.

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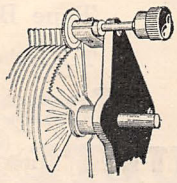
Ordinary adjustments reduced by separate geared adjustment to hairbreadth distinction. We guarantee the Heath Vernier Condenser to be more highly selective than any condenser employing a vernier which actuates ALL of the plates.



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Ask your dealer or write for name of nearest distributor.

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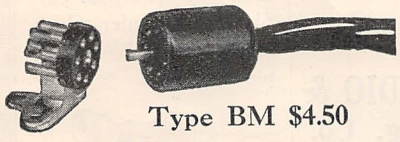

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CANADA—1af, 1ar, 1bq, 1dd, 1dq, 2az, 2be, 2bg, 2bn, 2cg, 3mv, 3bl.

Pse qsl: all crds answered. FB gang!

R-CB8, CARLOS BRAGGIO, CALLE ALSINA 412, BUENOS AIRES, ARGENTINA (NOVEMBER 1st TO 18th)

UNITED STATES—1xae, 1sf, 1ow, 2brb, 1abf, 6bjj, 7abb, 4pk, 3te, 2cvu, 8bau, 6agk, 6apw, 1pl, 8amr, 5mi.

CANADIAN—1ar.
CHILE—9tc.
BRAZIL—1ac, 2sp.
FRANCE—8ab.
ENGLAND—2nm.
NEW ZEALAND—4ag, 2ac, 4aa.

JOHN H.-P. ANDREWS, COR. LAKE AND BELLONA AVES., BALTIMORE, MD. (NOV.)

(Only 1 tube, 1 hour a night, 1 month, 3 circuit.)

4bw, 4cl, 4cs, 4eq, 4fz, 4io, 4jr, 4ke, 4ku, 4mb, 4mi, 4nj, 4pv, 4qy, 4rr, 4sa, 4sb, 4si, 4xau, 4xx, 5aaq, 5aax, 5ac, 5adh, 5aex, 5afu, 5agj, 5ags, 5ahd, 5air, 5aiu, 5aju, 5alr, 5am, 5ame, 5apc, 5ari, 5dw, 5ek, 5gf, 5gk, 5hu, 5jf, 5lh, 5lu, 5mi, 5nw, 5ot, 5ox, 5ph, 5ql, 5rh, 5rl, 5sd, 5se, 5uj, 5uk, 5uv, 5xau, 5zav, 6ac, 6adt, 6agk, 6ahp, 6aj, 6ajf, 6ajh, 6alb, 6alk, 6ame, 6ao, 6apw, 6arb, 6ase, 6avr, 6awt, 6bcr, 6bde, 6bdt, 6bez, 6bjj, 6bjx, 6blw, 6bny, 6bqa, 6bra, 6buf, 6buh, 6bur, 6caq, 6cax, 6cgk, 6cgo, 6cgs, 6cig, 6cix, 6cjj, 6clp, 6cms, 6cmu, 6cnl, 6css, 6ea, 6eb, 6gg, 6gt, 6lj, 6of, 6rm, 6ut, 6vc, 6vo, 6wi, 6ww, 6wt, 6xi, 6yh, 6zp, 7abb, 7acm, 7afn, 7afo, 7am, 7bj, 7dd, 7fd, 7gr, 7jq, 7lq, 7mf, 7ot, 7zz, 9aey, 9aio, 9aiu, 9aod, 9aor, 9axf, 9axt, 9axx, 9ay, 9ays, 9bcd, 9bcj, 9bfg, 9bfi, 9bfm, 9bga, 9bgh, 9bht, 9bhx, 9bie, 9biq, 9bje, 9bji, 9bkr, 9bm, 9bmv, 9bmx, 9bmy, 9bnf, 9bnk, 9bqa, 9btd, 9buh, 9buk, 9cap, 9ccm, 9ccv, 9cdv, 9cee, 9cej, 9cer, 9chc, 9cia, 9cip, 9ciu, 9cjc, 9ckb, 9clj, 9clq, 9clx, 9clz, 9cmg, 9cmx, 9cov, 9cp, 9cpm, 9ctr, 9cv, 9cvs, 9cxx, 9cyd, 9cyy, 9czv, 9db, 9dbp, 9dct, 9ddf, 9ddp, 9ded, 9deu, 9dev, 9dfh, 9dfq, 9dfv, 9dgv, 9dhq, 9dkt, 9dlm, 9dms, 9dng, 9dp, 9dpl, 9dpo, 9dpx, 9dyt, 9eas, 9ebh, 9efh, 9efj, 9efz, 9egh, 9egu, 9ehs, 9eht, 9ehy, 9ej, 9ejy, 9ek, 9eky, 9elb, 9eld, 9ell, 9es, 9fm, 9hn, 9in, 9jc, 9mf, 9mn, 9ny, 9oa, 9of, 9qi, 9qw, 9tg, 9ti, 9vz, 9xay, 9xbp, 9xi, 9yb, 9yx, 9zd.

CANADA—1ar, 1dq, 2qh, 3aa, 3ac, 3bg, 3ly, 3tf, 3zt, 4cr, 5go.

ALSO—nkf, nfv, wgh.
FRENCH—3ab, 8go.

8ZE-8GX—OBERLIN, OHIO (Nov. 1 to Dec. 1.)

(6aao), 6adt, (6afg), (6agk), 6aha, (6ahp), (6aiq), (6ahj), 6alk, (6ame), 6apw, 6arb, (6arx), (6awt), (6bdt), (6bjj), (6blw), 6bon, (6bqr), 6bqu, (6cgo), 6chl, 6cla, (6cix), (6cmi), (6cnl), (6css), 6cto, 6cvm, 6ac, 6cg, (6eb), (6gt), 6lj, 6lv, 6ne, 6of, (6oi), 6ol, 6pl, (6rm), 6vc, 6vo, 6xi, (6zp), 6z? (hrd. 10:30 a.m., Nov. 16th).

7abb, 7afo, 7 aij, 7fd, (7fq), (7gb), 7gr, 7ij, 7ix, 7mf, 7ot.

CANADA—c4cr, (c5an).
PORTO RICO—4sa.
MEXICO—bx.
ENGLAND—g51f, g2yt.

8ze-8gx (6awp) is on 78 meters with 50 watts in Meissner Circuit and wud appreciate reports on signals. Will be glad to qse to all stations on receipt of their station card. All cards answered.

9BHH, LEO JUNGE, 224½ E. THIRD ST., DAVENPORT, IOWA

1aal, 1alj, 1bep, 1bis, 1by, 1iw, 1kc, 1pl, 1wc, 1zz, 2aay, 2anm, 2brb, 2by, 2cxy, 2jo, 2rz, 2iu, 2iw, 3bcd, 3bfe, 3bta, 3xp, 4adq, 4gw, 4cp, 4io, 4jr, 4qf, 4tj, 4xe, 4hl, 5acf, 5agj, 5ago, 5ahj, 5aiy, 5amh, 5ams, 5amw, 5ajj, 5aqy, 5ck, 5cn, 5ec, 5ek, 5gj, 5ka, 5mi, 5se, 5ua, 5ve, 5xa, 5za, 5zk, 5kc, 8aal, 8ada, 8adk, 8afn, 8aig, 8aih. 8ain, 8ah, 8ajf, 8ak, 8ald, 8aln, 8alx, 8an, 8aoq, 8apn, 8apw, 8ald, 8anb, 8aqf, 8aub, 8av, 8axf, 8axt, 8axo, 8axu, 8bau, 8bch, 8bcu, 8bh, 8bhg, 8bfm 8biq, 8bjt, 8bjz, 8bjy, 8bkm, 8bko, 8bn, 8bnc, 8bnh, 8bo, 8boq, 8bp, 8bpa, 8bpl, 8bqi, 8brc, 8bsf, 8btf, 8bud, 8bvr, 8bwp, 8bwk, 8bxh, 8byn, 8bzd, 8bzf, 8cbp, 8cci, 8cdd, 8ced, 8cei, 8chx, 8ckd, 8cke, 8cmt, 8cng, 8cnl, 8coc, 8cpk, 8cnf, 8crl, 8cse, 8cud, 8cwf, 8cwp, 8cyi, 8cyt, 8daa, 8dal, 8daw, 8dfo, 8dgj, 8dgl, 8dgp, 8dgo, 8dgt, 8dha, 8dhp, 8dhs, 8dhw, 8dig, 8dnk, 8dno, 8dny, 8doj. 8dok, 8dco, 8dri, 8eb, 8er, 8es, 8gz, 8hn, 8pl, 8pu, 8nz, 8rj, 8sf, 8up, 8vt, 8vw, 8wa, 8xb, 8xbc, 8xc, 8wx, 8xs, 8zd. 8zf, 8zg, 8zy, 8zz.

FONE—8brc, 8xs, 9aaw, 9bíb, 9brb, 9bsb, 9ciq, 8dmc, 9xw.

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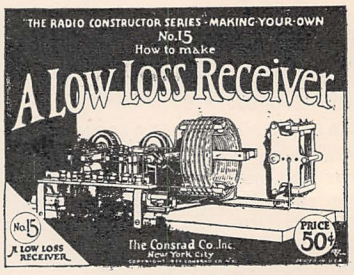

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Just Off the Press. A new pattern on the standard high efficiency LOW LOSS Receiver embodying every notable advance in this type of receiver. The blueprint of the wiring diagram incorporates a unique, new idea that simplifies radio receiver building. The wiring of each circuit is shown in a separate color, thus: Green for the aerial circuit, Yellow for the low potential or ground, Red for the plate and "B" battery and White for the grid circuit.

The Pattern contains two full sized blueprints size 14x19 inches, giving special wiring diagram in four colors and a panel layout and a complete 16 page booklet. The pattern comes in a handsome heavy color folder size 9x12 inches.

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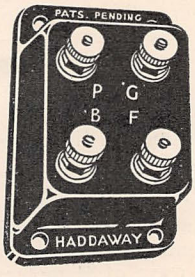

A big advance over iron core transformers. A big advance, too, over other resistance couplers. They come perfectly adjusted—trig and tight—no loose connections to mar reception. In your factory-made or home-built set, use Haddaway Resistance Coupling Units, $5 each.

Ask your dealer, or write direct to us.

HADDAWAY Resistance Coupling Unit

HADDAWAY INCORPORATED
1866 SO. HOOVER ST., LOS ANGELES, CALIF.

MISCELLANEOUS — KDKA, 94-68 meters, KFKX, 100; NFK, WGH, 93-103; WGY, 100.
CANADIAN—3ms.
FRENCH—8dn. qrk? bhh.

6AB, BOX 494, BLYTHE, CALIF. (OCTOBER AND NOVEMBER)

1aal, 1abf, 1ajw, 1all, 1apx, 1atj, 1ba, 1bdx, 1boa, 1bu, (1gv), 1kc, 2acs, 2afp, 2al, 2brb, 2buy, 2by, 2cee, 2cel, 2cgb, 2cjj, 2cjx, 2cpa, 2crp, 2cvj, 2rk, 2wz, 2kf, 2za, 3ad, 3agf, 3aoj, 3bgg, 3bhv, 3bng, 3bgp, 3bss, 3buy, 3bvn, 3cdu, 3cgs, 3chg, 3cjn, 3ckl, 3dd, 3hd, 3hg, 3kg, 3lg, 3mf, 3ot, 3pp, 3qw, 3tp, 3zo, 4bg, 4ft, 4gh, 4gw, 4hr, 4jr, 4my, 4pb, 4si, 4su, 4ua, 5aan, 5aao, (5aag), 5abc, 5abj, 5acb, 5acf, 5acl, 5acm, 5ad, 5ade, 5adk, 5adm, (5ado), (5dz), 5aed, 5aef, 5aek, 5aex, 5afg, 5afx, 5agn, 5ahd, 5air, 5aja, 5ajb, 5ajg, 5ajj, 5ajt, (5ak), 5akd, 5akf, 5akn, 5akq, 5am, 5amu, 5amw, 5ana, 5anl, (5ap), 5apg, 5aph, 5api, 5agw, 5asb, (5asd), 5be, 5bj, 5br, 5bwt, 5bx, 5cc, 5ce, 5co, (5ed), 5ek, (5ew), 5ez, 5gu, 5hl, 5hp, 5hu, 5hw, (5hy), 5in, 5jf, 5kc, (5lh), 5ll, 5ls, 5nw, 5oq, 5ox, (5pa), 5po, 5ga, 5gh, 5gs, 5qz, 5sd, 5se, 5sk, 5tn, 5ua, 5ux, (5vu), (5wa), 5wi, 5xa, 5yd, 7ao, (7acf), (7afp), 7ajt, 7alk, 7qb, 7gj, 7gs, 7kz, 7lh, 7ls, 7mf, 7mp, 7no, 7ob, 7ok, 7ot, 7oy, 7gc, 7gf, 7gw, 7gy, 7ry, 7to, 7zn, 8aal, 8aam, 8acq, 8aip, 8alx,, 8alq, 8apn, 8apt, 8bbf, 8ben, 8bfe, 8bit, 8blp, 8bpu, 8brc, 8brm, 8btf, 8cbp, 8ced, 8cgf, 8ckp, 8cpk, 8cse, 8dae, 8dal, 8dbm, 8dbo, 8dc, 8dea, 8dfm, 8dfo, 8dga, 8dgl, 8dgp, 8dgt, 8dki, 8dnf, 8dnk, 8dwj, 8eb, 8gz, 8hn, 8nt, 8pl, 8rj, 8ta, 8tp, 8tt, 8ue, 8uq, 8vq, 8wg, 8xe, 8xk, 8zy, 9aad, 9aal, 9aau, 9aav, 9acq, 9ado, (9adq), 9aef, 9aey, 9afi, 9afp, 9agr, 9ahg, 9ahv, 9aid, 9aim, 9akd, 9akn, 9amb, 9amp, 9amu, 9amx, 9an, 9aob, (9ape), 9asd, 9ash, 9auc, 9avs, 9avu, 9awu, 9axs, 9ayq, 9bbj, 9bcj, 9bdf, 9beg, 9bez, 9bfg, 9bhf, 9bhx, 9bio, 9bis, (9bji), 9bjk, 9bkj, 9bkz, 9blb, 9bmc, 9bmk, 9boa, 9bob, 9bof, 9bpp, 9bgh, 9bqj, 9brq, 9bvk, 9bvn, 9bvu, 9bwx, 9bxh, 9byl, 9bzj, 9caa, 9cap, 9cco, (9ccs), 9cde, 9cdo, 9cdw, 9cea, 9ceb, 9cee, 9cgn, 9cgs, 9cii, 9cjc, 9cjm, 9cjy, 9cld, 9ckd, 9cov, 9cpm, 9cpy, 9cri, 9csq, 9cuc, (9ctg), 9cvn, 9cvs, 9cwf, 9cyd, 9cyx (9dac), 9dad, 9dap, 9daw, 9dbr, 9dbz, 9ded, 9dew, 9dhg, 9dhl, 9dhw, 9dig, 9djp, (9dkv), 9dlh, 9dlo, 9dlt, 9dof, 9dpx, 9drt, 9dte, 9dun, (9dvi), 9dvr, 9eam, 9ecl, 9eeb, 9eel, 9efh, 9efj, 9ejn, 9ejy, 9eky, 9ely, 9er, 9hn, 9lb, 9mi, 9mm, 9pw, 9ro, 9rt, 9rx, 9su, 9tw, (9wo), 9xi, 9zt.
CANADIAN—1ar, 2cq, 3ly, 4ad, 4aw, 4fh, 5an, 5ba, 5gf, mBX, m1E, q2BY, 81X, NSE, NUJX, D9K, CHGO, WGH.
DALITE—3ph.
FONE—(9aoi).
ITALIAN—IHT.
ARGENTINA—CB8, LPX.

6CUW, D. C. MAST, BISBEE, ARIZ.

5bj, 5cc, 5ce, 5ck, 5es, 5gu, 5hi, 5kc, 5ld, 5lh, 5ls, 5ms, 5pp, 5qy, 5se, 5uj, 5ux, 5abj, 5abw, 5adv, 5adz, 5aex, 5afg, 5afh, 5agn, 5agq, 5aji, 5ajv, 5akf, 5alm, 5alu, 5ajt, 5amw, 5apm, 5aqd, 5are, 5zai, 5asb, 6dd, 6fm, 6gv, 6ih, 6jj, 6ld, 6lj, 6oo, 6pz, 6rf, 6uf, 6wt, 6aam, 6abe, 6afg, 6afn, 6aij, 6ajh, 6aji, 6aga, 6akw, 6ano, 6aoa, 6asb, 6asv, 6ava, 6bbq, 6bho, 6bjc, 6bkv, 6bqf, 6btp, 6bts, 6bwl, 6cah, 6cdg, 6cdn, 6cfs, 6cgv, 6cgw, 6chx, 6cje, 6cnk, 6cnl, 6cqe, 6crs, 6crx, 6csr, 6csw, 6ctl, 6cto, 6cub, 6xad, 6zbh, 7co, 7ob, 7oi, 7sl, 7ahc, 7ahs, 8doo, 9ea, 9em, 9fm, 9rx, 9wi, 9wo, 9acq, 9aim, 9aob, 9aoi, 9atl, 9bcb, 9bdu, 9bez, 8bjk, 9blb, 9bnk, 8bof, 9bqj, 9bsp, 9bxg, 9caa, 9cea, 9cht, 9ckj, 9ckm, 9cld, 9cms, 9czg, 9dhq, 9dhw, 9dhy, 9dov, 9dpp, 9eam.

9APY—3337 OAK PARK AVENUE, BERWYN, ILL.

1abf, 1ajx, 1alw, (1amf), 1apf, 1aw, 1bdx, 1biq, 1bom, 1hj, 1ml, (1or), 1pp, 2aan, (2agm), 2agw, (2al), 2apv, 2bbn, 2bbx, 2be, 2bfe, 2bmq, 2buy, 2cgb, (2cnk), 2cwj, (2cwt), 2cxg, 2fc, 2ha, 2kf, 2mc, (2zb), 3abw, 3ach, 3ajp, 3auv, 3awu, 3bei, 3bfq, 3bu, 3cdg, 3cgc, (3cgs), 3chc, 3kl, 3nf, 3nw, 3ol, 3pp, 3wf, 3xx, 3zg, 4af, 4db, 4eq, 4fa, 4io, 4iz, 4jr, 4si, 4uk, 5aaq, (5adw), (5aek), (5akp), 5aqp, 5arb, 5atf, 5atx, 5ls, 5ot, 5qh, 5ux, 6arb, 6bka, 8s and 9s too many.
CANADIANS: c-2dn, (c-4ae).
FONES: 3xan, 5apz, 5qd, 8ais, 8brc.
A card awaits every QSL.

6CLZ-6COW—1045 PERALTA AVENUE, BERKELEY, CALIF.

UNITED STATES: 1aac, 1abf, 1abs, 1ana, 1are, 1ary, 1atj, 1aww, 1bhm, 1bie, 1bip, 1bko, 1bsd, 1bvl, 1cak, 1cbr, 1ckp, 1cme, 1cmp, 1bv, 1er, 1gs, 1id, 1kc, 1my, 1ow, 1pl, 1sf, 1wf, 1xae, 1xam, 1xz, 2afp, 2ana, 2anm, 2bgi, 2bgo, 2bqc, 2bqu, 2brb, 2bsc, 2cee, 2cgi, 2chk, 2cjj, 2cpa, 2cpk, 2cvj, 2czr, 2ag, 2br, 2by, 2dn, 2kr, 2ku, 2mu, 2pd, 2rk, 2xi, 2xq, 3adq, 3aih, 3ajd, 3bhv, 3ccx, 3chg, 3chk, 3cjn, 3ab, 3hg, 3hh, 3ll, 3sf, 3wb, 3wu, 3yo, 4bq, 4gw, 4io, 4jr, 4kl, 4ku, 4oa, 4tj, 4xe, 5aaq, 5acx, 5aex, 5afu, 5ahd, 5aij, 5ail, 5aiu, 5ajh, 5akn, 5ame, 5amw, 5aoj, 5aqw, 5asi, 5ap, 5ca, 5cn, 5cv, 5dm, 5dw, 5ek, 5id, 5in, 5ka, 5lh, 5li, 5lu, 5mi, 5nw, 5oq, 5ox, 5ph, 5qy, 5sd, 5se, 5uk, 5xau, 5za, 5zai, 5zav, (too mani 6s and 7s), 8ada, 8adg, 8adk, 8ads, 8afn, 8agm, 8ago, 8ame, 8amr, 8aro, 8atp, 8ayu, 8bau, 8bbf, 8bdk, 8bjv, 8bqr, 8btf, 8buk, 8cbp, 8ced, 8cko, 8cyi,

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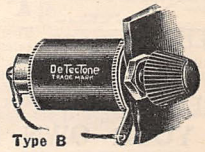

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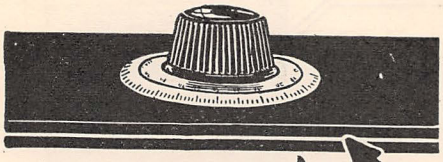

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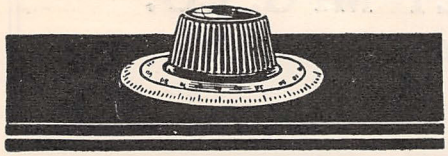
SEATTLE, 1041 Sixth Ave. So.
(Offices and agents thruout the world)



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on each card. Be individual. Good grade cards. Quality printing. Attention Getting Thank You Cards: 100 only $1.00; 200—$1.60; 300—$2.00; 500—$3.00; 1000—$5.00 (only ½c each). PREPAID if you prefer to pay with order.

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Order Today—NOW. A postal will do.
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8dae, 8dal, 8dgp, 8dhw, 8dme, 8dnf, 8doo, 8dse, 8ah, 8bo, 8cp, 8gz, 8hn, 8jq, 8kc, 8pd, 8pl, 8rj, 8rv, 8ry, 8tr, 8up, 8vq, 8xav, 8yv, 8ze, 8zk, 9abf, 9aby, 9adq, 9aen, 9aim, 9aio, 9amb, 9amx, 9asw, 9auy, 9awe, 9axs, 9axx, 9bag, 9bcj, 9bdf, 9bdw, 9bfg, 9bgh, 9bht, 9bhx, 9bkb, 9bmu, 9bmx, 9bnk, 9bof, 9bpy, 9brx, 9bso, 9bye, 9caa, 9caj, 9cbz, 9ccs, 9cdv, 9cea, 9cee, 9cfi, 9cgd, 9cgx, 9cii, 9cip, 9cju, 9cjy, 9ckb, 9cpm, 9ctr, 9cvo, 9cvs, 9cyx, 9dac, 9ddp, 9ddv, 9ded, 9dev, 9dfh, 9dge, 9dgv, 9dlt, 9dmj, 9dng, 9dqu, 9dtk, 9dyn, 9eak, 9eam, 9eas, 9efh, 9efy, 9efz, 9egh, 9eky, 9elb, 9ei, 9em, 9ep, 9es, 9hn, 9mc, 9mm, 9ny, 9sx, 9xbg, 9xi, 9yb, 9zb, 9zd, 9zt

NFV, NFK, WGH, CANADIAN: 3ad, 4cl, 4cr, 4io, 5ac, 5an, 5ba, 5bz, 5ef, 5gf, 5go.
MEXICAN: 1b, bx.
NEW ZEALAND: 2ac, 4ak.
All crds gladly answd, pse QSL.

6BDH, BOX 494, BLYTHE, CALIF. (NOVEBER 29 TO DECEMBER 18)

1aac, 1aay, 1aja, 1ajo, 1axz, 1emp, 1fd, 1fv, 1gv, 1lc, 1lw, 1ow, 1py, 1wl, 1xam, 1yb, 2aan, 2ag, 2agk, 2ana, 2anm, 2brb, 8bsc, 2cee, 2cei, 2cgb, 2cty, 2cvu, 2czr, 2eg, 2kf, 2ku, 2kx, 2rk, 2xq, 3adb, 3ade, 3adf, 3ajd, 3auv, 3bco, 3bjp, 3bmn, 3bof, 3bwj, 3bz, 3cdg, 3chc, 3chg, 3cjn, 3ckp, 3hg, 3mf, 3ot, 4eq, (4fz), 4jr, 4ka, 4kt, 4ku, 4oa, 4si, 4tj, 4uk, 4xe, 5aaq, 5ac, 5acl, 5adh, 5aeq, 5aex, 5afu, 5ahd, 5ahj, (5aiu), 5aiy, (5ajb), 5ak, 5akh, 5akl, 5akx, 5alr, 5ame, api, 5apm, 5aqm, (5aqw), 5bj, 5ca, 5ce, 5dm, 5dw, ek, 5ew, 5ik, 5in, 5jf, 5ln, 5lu, 5mz, 5nw, 5ao, (5oq), 5ov, 5ph, 5qj, 5qy, 5sd, (5se), 5uj, 5uk, 5ux, 5xau, 5xa, 5za, 5zav, 7abb, (7adm), (7afo), 7agn, 7ahs, 7ajt, 7akh, 7di, 7fd, 7fm, 7fr, 7ge, 7ho, 7ij, 7jq, 7ku, 7lu, (7lq), (7ly), 7mf, 7mp, 7no, 7nt, (7ot), 7oy, (7qd), (7sp), 7sy, 7zq, 8acy, 8ah, 8alf, 8aro, 8ayu, 8bau, 8bf, 8bxh, 8cav, 8cea, 8ced, 8cp, 8cq, 8cxi, 8cy, 8cyi, 8dal, 8dgp, 8dnv, 8gq, 8gz, 8ih, 8lr, 8oe, 8pl, 8rg, 8tr, 8uf, 8up, 8vt, 8xk, 8ze, 8zt, 9aad, 9abf, 9aby, 9ado, 9afz. 9aim, 9aj, 9aju, 9anj, 9arr, 9asq, 9avj, 9avv, 9axs, 9axt, 9axx, 9bcj, (9bdf), 9bdu, 9beg, 9biq, (9bht), 9bje, (9bm), 9bmu, 9bna, 9bnf, 9bnk, 9boa, 9bvz, 9bwb, 9caa, 9cap, 9ccm, 9ccs, 9cdv, 9cfr, 9cfy, (9cip), 9cju, 9cjy, 9ckj, 9ckv. 9cp, 9cpm, 9csg, 9ctg, 9cvf, 9cvn, 9cvo, 9cxx, 9dap, 9db, 9dbj, 9dec, 9deu, 9dev, 9dfv, 9dge, 9dkr, 9dkv, 9dlo, 9dms, 9dqu. 9dun, 9dwx, 9eak, 9efh, 9eky, 9ely, 9ep, 9ev, 9hn, 9lb, 9nv, 9vd, 9zd, 9zt, NKF.

CANADIAN—2be, 3bp, 3oo, 3zt, 4cr, 4io, 5an, 5bz, 5go.
NEW ZEALAND—2ac.
MEXICAN—1k, lb.
ARGENTINE—CB8, LPX.

PERCY A. FIELD, CANADIAN 4CL, WIRELESS OPERATOR, S.S. "VANCOLITE," BALTIMORE, MD.

Night of November 11th. Anchored at Cabo Blanco, Peru. Latitude 4° 24′ South. Longitude 81° 05′ West. (Detector only.)

3te, 4eq, 5uk, 5ail, 6to, 6xi, kdka, wgh.

Night of December 15th. Anchored at Lobos Island, Mexico. Latitude 21° 25′ North. Longitude 97° 18′ West. (Detector and 1 step.)

1alw, 1akz, 1bv, 1bkq, 1bjo, 1cmc, 1cme, 1ez, 1ld, 1yb, 2by, 2cee, 2ku, 3bnq, 3bss, 3bum, 3chc, 3hg, 4gw, 4mb, 4oa, 5adz, 5ail, 5anl, 5api, 5dw, 5ei, 5kc, 5lu, 5uk, 5xau. 6alv, 6cns, 6csg, 6xi, 7ls, 8anb, 8apr, 8apz, 8avd, 8bqa, 8bpv, 8cse, 8dbo, 8dgt, 8dhn, 8er, 8xe, 8ze, 9abf, 9afw, 9aot, 9bay, 9bdf, 9bdw, 9bof, 9bqj, 9brq, 9bwp, 9bxg(?), 9cjc, 9cto, 9cvn, 9cyk, 9ddt, 9ded, 9dhs, 9dmz, 9dwx, 9ep, 9efm, 9eky, 9of, 9tg.

BRITISH—2JF, 5lf.
MEXICAN—1b.
WVZ, 6B, QRA?.

J. G. RITCHIE, 314 RENFREW STREET, GLASGOW, SCOTLAND. (NOVEMBER 23 TO DECEMBER 12 ON REINARTZ DET. 1AF.)

ALL U. S.—1bx, 1bz, 1da, 1dd, 1er, 1gv, 1hn, 1ll, 1my, 1sw, 1xm, 1xz, 1aac, 1aar, 1abf, 1adj, 1aea, 1afa, 1afc, 1amw, 1anh, 1anr, 1apk, 1atj, 1aur, 1bal, 1bdt, 1bgq, 1bvl, 1cab, 1ckk, 1cme, 2ag, 2br, 2by, 2eq, 2ld, 2lw, 2mc, 2mu, 2pl, 2ud, 2xi, 2aay, 2anh, 2anm, 2awf, 2axf, 2azy, 2bcu, 2bgg, 2cee, 2cla, 2ixd(?), 3ah, 3ap, 3hh, 3jo, 3oq, 3adb, 3ajd, 3bob, 3bof, 3chg, 4ca, 4ch, 4du, 4eh, 4ke, 4sa, 4sb, 4xe, 8pl, 8vq, 8aly, 8ame, 8bjv, 8dal, 8dea, 8xav, 9ei, 9zt.

CANADIAN—1ar.
NAVAL—nkf.
WITHOUT ANTENNA OR GROUND—1fd, 1sf, 1vj, 1ajg, 1bjm, 1brx, 1ckp, 1cmp, 2mf, 2pr, 2xq, 2aay, 2anm, 2aty, 2auf, 2bco, 2bqu, 2bsc, 2bsl, 2cbg, 2cco.

NEW HIGH POWER NAVY TRANSMITTER

Super power in radio, as it has become familiar to broadcast listeners, will be dwarfed by the 80 k.w. vacuum tube transmitter for which the United States Navy Department has just placed an order with the Radio Department of the General Electric Co., Schenectady, N. Y. The transmitter will not be for telephone use, how-

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ever, but will be designed for telegraph code communication only, at speeds up to 100 words per minute, which is about twice as fast as the average conversational speech. It will be used to carry on the routine business of not only the Navy Department, but other departments of the Government as well. From its intended location at Mare Island, Calif., it will communicate direct with the navy's high power station at Annapolis, Md., near Washington; with the Hawaiian Islands, with Japan and with other countries, and our battleships and destroyers practically anywhere on the Pacific Ocean. When completed, it will be the most powerful vacuum tube transmitter in the United States, if not in the world.

In ordering this tube transmitter, the Navy Department has inaugurated a policy which may bring about in a few years the complete elimination of the arc transmitters now in use in its high power stations. The first transmitters used in the Navy's stations were of the spark type which radiated a discontinuous or damped wave. These were replaced by the present type of arc transmitters which were a great improvement and gave greater effectiveness in providing communication because they radiated a continuous or undamped wave. The tube transmitters, however, are now displacing the arc transmitters because, among other reasons, of their higher efficiency and lower operating cost.

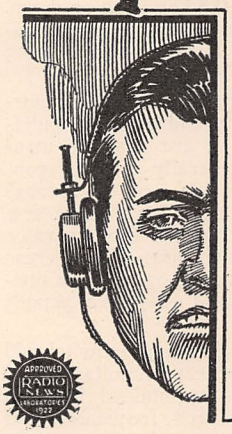
TO REDUCE INTERFERENCE TRANSMITTER

In adopting the tube transmitter the Navy officials were influenced by a desire to reduce the interference to broadcast listeners. The arc transmitters have always been a source of interference, producing arc "mush" and harmonics. This did not matter so much before the advent of broadcasting. Now, however, due to the rapid growth of broadcasting, conditions are different and the Navy Department is co-operating with the Department of Commerce to clear the air of interference for the benefit of broadcast listeners. For example, the Annapolis station, the highest power Government station, located a few miles from Washington and Baltimore, is shut down two hours every evening from eight to ten o'clock in order to clear the air from interference in that area. The Annapolis station has two arc transmitters, each rated at about 300 k.w., and except for the daily silent period it is in nearly continuous operation, communicating with various European and South American countries as well as the Navy's Pacific Coast stations. With a tube transmitter of equal range installed, the station could be operated 24 hours per day, due to the freedom of the tube transmitter from "mush" and harmonics. On account of the long wave-length used, which is approximately 10,500 meters, broadcast listeners would be entirely unaware that it was in operation because their receivers would be tuned only for short wave-lengths.

ADVANTAGE OF TUBE OVER ARC

Before asking for bids on the new transmitters, a careful study was made of the high power station at Annapolis. Here the Navy's largest arc transmitter is located, rated at 300 k.w. input to the arc. A comparison was made between this arc and the proposed tube transmitter, which revealed some rather startling information. For instance, it was found that the 80 k.w. tube set would deliver more current to the antenna and would have a greater communication effectiveness than the 300 k.w. arc has at present. It was found that even after deducting as an operating charge the cost of the vacuum tubes used, the tube set would pay for itself through the saving in power bills alone in less than four years. This is brought about by the fact that the tube transmitter, due to its higher efficiency, draws

What a Difference Fil-KO Parts Make!



RECEPTION may mean anything from the satisfaction of hearing local and distant stations loudly and clearly to straining your nerves trying to make out weak distorted signals. You can get *reception* with any sort of tube control, but what a difference Fil-KO Parts will make! They assure scientifically correct control—faultless radio reception—which means all the stations you ever received—and others you never heard before—come in loud and clear regardless of distance or wave length.

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Fil-KO Stat helps you get greater distance, louder signals, sharper tuning, freedom from tube noises. It is the only rheostat that enables you to get maximum audibility with any type of tube in any hook-up. The *improved* model is fitted with battery switch that attaches to mounting screws. Distinctly signals "on" and "off". Enables you to break circuit without changing adjustment.

Fil-KO Resistor across your A. F. transformer assures better reception. Adjust it for greatest volume and least distortion. *Fil-KO Resistors* are also used in resistance coupled amplification. Resistance read in ohms through panel peep-hole. (Baseboard mounting and brackets for transformer terminals furnished). Resistance element has same good qualities as that of *Fil-KO Leak*. Individually calibrated. 5,000-250,000 ohms.

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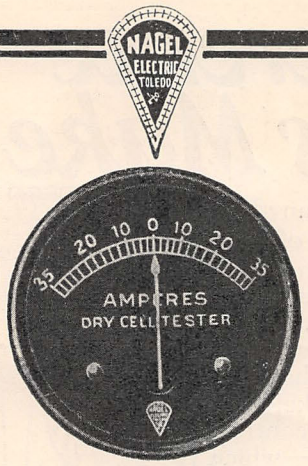

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You can't tell by looking at them. But this Nagel Ammeter will give you the amperage in a second!

A new "A" dry cell should deliver about 35 amperes on short circuit. It will continue to give satisfactory results until the reading drops to about 15 amperes. Below this point no radio set can be operated satisfactorily.

Buy a Nagel Ammeter—not a new venture for this firm which has been manufacturing measuring instruments for years. Over 6,000,000 are in daily use on automobiles of every make.

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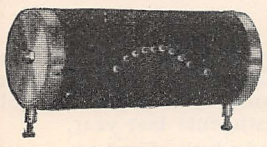
HOT MOULDED INSULATIONS



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The only one control tuner, 200 to 600 meters, complete with hook-ups mailed anywhere. **$1.50**

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only approximately 150 k.w. when the sending key is depressed and only about 20 to 25 k.w. when the key is up, which is estimated to be about two-thirds of the time. This is in marked contrast to the arc transmitter which consumes around 300 k.w. or twice as much power, and this consumption is for all of the time that the arc is in operation, regardless of whether the key is up or down. The only energy consumed by the tube transmitter when the key is up is for lighting the filaments of the tubes.

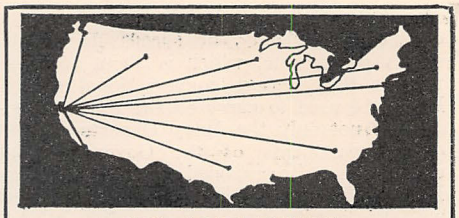
Other points in favor of the tube transmitter are its simplicity and ease and quietness of operation. The arc must be manually started. It is generally operated continuously for considerable periods because it is impractical to shut it down for a few minutes at a time. It requires cooling water at about 30 to 35 pounds pressure, whereas the tube transmitter needs only about one-fifth as much water and only five pounds pressure.

The arc transmitter has approximately 60 relays, all of which operate simultaneously. These relays must be maintained in good condition, contacts renewed frequently, and kept in accurate adjustment. If the adjustment is not perfect, a ragged signal is the result. The relays are very noisy in operation. All this is far different in the tube transmitter, which has only one very small high speed relay, carrying practically no current and having no sparking at the contacts to destroy them quickly. The tube transmitter is quiet in operation, the only noise being the running of a small motor generator set which is used to light the filaments. The tube transmitter can be easily arranged for remote control, not only of the keying, but also of starting and stopping. This means that the operator in the Navy Department's communication center in Washington could have complete control of the transmitter at Annapolis, some 30 miles away.

ARC EMPLOYS TWO WAVES

The present arc transmitter at the Annapolis station has a compensating wave, thus utilizing two communication channels. The keying of the arc transmitter is effected by short-circuiting a portion of the antenna loading inductance, thus changing the wave-length a few meters. The wave-length is one value when the key is down and another when the key is up, but the transmitter is radiating energy all the time. The tube transmitter only utilizes one communication channel and only radiates when the key is depressed. With the present congestion in the ether and the limited number of communication channels which are available, this becomes an important feature.

The 80 k.w. tube transmitter is of the latest type, using a 6-phase vacuum tube rectifier to furnish direct current power at 15,000 volts, 7.5 amperes for the plates of the oscillator and amplifier tubes. The rectifier operates from ordinary commercial 60-cycle, 3-phase power. This alternating current is first stepped up to a high voltage by means of a transformer and then, passing through the six kenotron tubes, is converted to direct current power. A suitable filter, consisting of condensers and a reactor, is used to smooth out the ripple in the rectified current. For the transmitter proper, the master oscillator power amplifier circuit is used in conjunction with a tank circuit to insure the elimination of harmonics from the radiated output. The master oscillator uses a single tube which generates the radio frequency power. This power is then fed into the power amplifier which consists of several pairs of "push-pull" units operating in parallel. These "push-pull" amplifier units are exactly the same in principle as the smaller units now popularly used in a number of radio receivers and power amplifiers for loud speaker work, the only dif-



ON ONE TUBE

BIG FREE BOOKLET tells the story. California users of CROSS COUNTRY CIRCUIT hear Atlantic Coast, Canada, Cuba, Mexico and Hawaii. Atlantic Coast users hear England to California. Our new plan makes this set easiest and cheapest to build. One hour puts in operation. One tuning control. No soldering. Any Novice can do it. BIG BOOKLET FREE or complete instructions for 25c stamps or coin.

WHAT USERS SAY

EAST—Am more than pleased with the parts ordered from you. The first night I hooked it up and received Omaha. Since then Minneapolis and Los Angeles. It works better without amplification than most sets with two stages. —Donals, S. C.

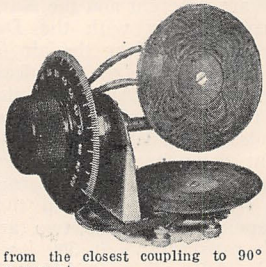
WEST—I am sending you a list of some of the stations heard on one tube: WSB, WGY, KDKA every night. PWX, WWJ, WTAM, WLW every night. CFAC, CHCB. Not long ago I purchased another set of parts from you and first night got WGR, Buffalo, and KDKA. —Ione, Calif.

NORTH—Received coils OK today. If I have same results with these that I had with last will be wanting more. I am 1,500 miles from nearest station and have picked 56 to date. Chicago, Havana, Mobile, New Orleans and TWO IN ENGLAND.——Lunenburg, Canada.

Vesco Radio Shop BOX RN-117 OAKLAND, CALIF.

KEY TO THE AIR

Real Low Loss Coils



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Low Loss Variable Inductance Unit

The Spiral Banking used in this Tuner gives low loss efficiency and high inductance value. The windings are so mounted that Key to the Air coils of other inductance value may be substituted. The mechanism of the Tuner control moves the windings with 180° of dial movement. from the closest coupling to 90°

Low Loss Tuner, TR-2.....PRICE $3.00

STAFFORD RADIO COMPANY
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ference being that in this case the output is several thousand times that of the "push-pull" amplifiers used for receiving work. The power output can be easily controlled either by reducing the plate voltage or by cutting out pairs of the "push-pull" amplifier units. Either way keeps the efficiency at a high percentage, notwithstanding the reduced output.

The tubes used are the 20 k.w. metal-type water-cooled, known as Radiotron, Model U-207.

How Radio Is Lifting the Level of American Women's Cookery

(*Continued from page* 1635)

unused to American ideas, and coming from parts of Europe primitive in ideas of cookery. They are learning modern cookery by radio with splendid results in home nutrition. This kind of Americanization is practical and productive and will be reflected in better national health.

Millions of American-born women, especially in the South and West, are woefully lacking in knowledge of food preparation and family feeding, and are hearing over the radio, perhaps for the first time in their lives, how to feed a growing child properly.

I am an enthusiastic "radio fan," therefore, not alone because I like to amuse myself with radio music, but because I realize that women are going to benefit far more than men from radio; it does so much to end their isolation. And, as I have indicated, radio does much more than merely bring music to women in their homes, it brings the greatly needed up-to-date *trade* knowledge of their chief profession of cookery, homemaking, child-raising, so vital to any Nation.

I sincerely hope, and fully expect, that radio is going to lift the level of woman's intelligence; lift the level of American cookery to a point where we need not be quite so ashamed of it as now, and lift child health to a higher point. Radio, and radio alone, has the magic power to do this, by its annihilation of distance and other barriers to the ears and attention of American women in those sections where advantages are few, reading scant and knowledge low. It should be good news to the American now that American wives are going to be better cooks, thanks to radio!

Marconi's Radio Beam Transmitter

(*Continued from page* 1625)

in other words, very great distances are not obtained in daylight.

BEAM AND HIGH-POWER STATIONS

From these considerations it will be seen that beam stations working between fixed points may be able to exchange as many words in 24 hours as high powered stations, and as the capital cost of the beam station should be only about an eighth of the large station, and the running expenses also much less, it is obvious that this new system of communication has great possibilities.

On the other hand, the fact that the high powered stations can transmit to any part of the world at any time during the 24 hours is obviously a point of great importance.

FROST-RADIO

Ask Your Neighbor

Accessories for your radio set

THESE dependable **FROST-RADIO** Accessories add to the satisfaction you will get from your receiving set. They make its operation easier and the results derived from it greater than would be the case were inferior apparatus used.

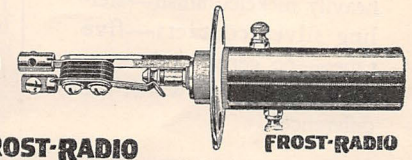
No. 262 2-Spring Type $1.00

PAN-TAB JACK SWITCHES A rugged, finely made jack switch, with on-and-off plate and pointer.

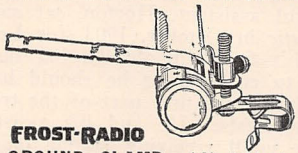
MUSETTE Phonograph Unit. A remarkable improvement over any similar device. **$5.50**

You can select any of these or other items of **FROST-RADIO** from the store of your neighborhood dealer with a certain knowledge that you will find the apparatus of the highest quality and full value for the price you pay.

MUSSELMAN Selective Antenna. An aerial that increases the selectivity of any set. 75 feet, **$5.00.**



LOOP AERIAL PLUG AND JACK. May be mounted on top of set, with loop mounted in plug. A popular item. **$1.50.**



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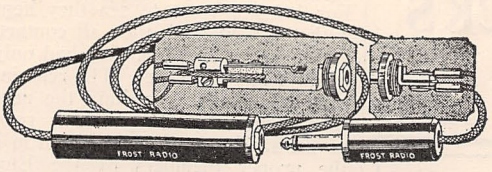

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A vital improvement!

MAR-CO SHUR-GRIP jacks—*with hooked terminals*—make set construction easier—short circuits impossible—and leak-proof connections permanent!

Formica insulation thruout—heavily nickeled finish—sterling silver contacts—five types—60 cents to $1.00—and mighty well worth the difference!

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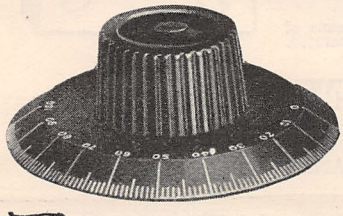
Any MAR-CO plug, with a SHUR-GRIP jack, is ample assurance that all the energy in your set . . actually gets to your speaker!



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Radion V-T Socket

The Life and Work of Lee DeForest

(*Continued from page* 1637)

began rolling into every crack and crevice of the little craft and at the same time the high tension currents began to flit merrily about over the gear. Every time a deckhand reefed a hawser he received a goodly fraction of it. Everyone, it seemed, became possessed of a sudden inclination to quit work. Those who stayed by the ship acted as if they had been fed on catnip.

But the races went on and the brick schooner was declared in wireless circles winner by a foul. The Marconi Company, having no recourse to an interrupter, struggled along as best they could through the terrible interference.

ENGLISH POST OFFICE DEPARTMENT CALLS FOR A DEMONSTRATION

DeForest came out of the tests with flying colors. Sir Thomas wrote him a cordial letter and set out again for his native shore. And evidently he meant the praise incorporated in it, for it was only a short time after the conclusion of the races that the DeForest Company received an invitation from the Post Office of Great Britain asking for a test of their apparatus, looking toward the establishment of a continuous service between England and Ireland.

DeForest, of course, was intensely gratified. England was the home of Marconi, and had been the scene of the first real experiments in wireless telegraphy. All aglow with his dreams, he picked up all the spare apparatus to be found and with his faithful assistant, Horton, set sail on the *Majestic* in October, 1903, for London. It was his first trip abroad, but he was too busy to enjoy it as he should have liked. All during the first part of the trip he was making tests. He and his assistant fitted out a small receiving station on the giant steamer and kept a constant lookout for signals from the various coastal stations. For 140 miles out to sea they kept in touch with the homeland, then all contact was lost.

Arrived in London, they had only a couple of days to themselves. The remainder of the time was spent in making the necessary arrangements with the London representative of the DeForest Company, and in looking up the proper members of the English Post Office. As soon as possible they set out for Holyhead, Wales. An English assistant, Fred Cornish, went with DeForest to Holyhead, Wales, and Horton took himself across to Dublin to establish the cross-channel station. A couple of old second-hand gas engines were purchased and forced into service. The Holyhead station was housed in an antiquated coast guard shelter above the Holyhead Light on top of a cliff which rose a sheer 600 feet out of the sea. The mast was erected, but the ground net had to be anchored to the rocks and the radio apparatus hauled up by main force.

Those who have not experienced a bleak winter on a high, unprotected English headland, where the Atlantic gales have full sweep, will have a difficult time picturing the hardships under which this station was erected. The weather was so damp that great difficulty was found in insulating the high voltage currents inside the station and on the antenna.

THE IRISH SEA SPANNED

But the work went on apace. In the face of the dampness, the condenser jars had to be immersed under kerosene to keep them from constantly breaking down. But within two weeks the official trials were ready to start. It was half with a sinking heart for fear that the signals would not come through and half

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is the most ideal for the Home Set Builder to use.
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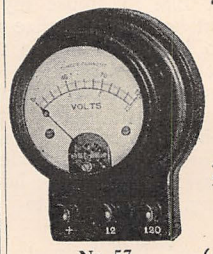

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7½ and 150 Volts

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(Also Other Ranges)

Run-down and poor batteries cause over 60% of radio trouble. Batteries should be tested often.

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REBUILD YOUR RADIO
Make it a SUPER-HETERODYNE that will not repeat

Get Aberdeen, Madrid, Havana, Mexico City, Los Angeles on loud speaker, with indoor loop. Tune out local stations at will. Enjoy 100 per cent reception.

Pinkerton has simplified Superheterodyne so that a twelve year old boy can build it. His matched and balanced transformers and oscillator coupler are called "the heart of Superheterodyne." They make a set that is unbeatable—think of it—one that is without harmonics—no station comes in twice on the dials.

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Simply send a two dollar bill as a deposit and receive Pinkerton Life-Size Plans and Photos complete with A.B.C. instructions, by return mail. They are sent on approval. They are not sold until you see them. Then if not all you expected give them right back to the Postman and your deposit will be returned, without question, immediately.

If you accept this offer, and find the life-size plans, photos, and complete directions as represented, you will be entitled to purchase the Pinkerton Heart of Superheterodyne, four matched and balanced transformers and oscillator coupler, regularly selling at $32.50, for only $23 additional.

Send name, address and $2 bill today.

THOMAS N. PINKERTON, *President*
PINKERTON RADIO CORPORATION
Superheterodyne exclusively.
1834 Broadway New York
Cut out this offer. Free booklet.

in a mood of the sheerest exhultation that DeForest retired the night before the day assigned for the tests.

The day dawned a fair one. The operators went to their posts and the tests began. From the first No. 1 to the complete signature of the last message and the operator's gn, everything came through booming. It was too much. There was the inevitable anticlimax. DeForest went to an inn, enjoyed a flagon or two of good old English ale and then sought a dark corner to pour out his feelings to his diary.

THE POST OFFICE OFFICIALS CHANGE THEIR MINDS

Next morning, back to the high hatted authorities of the British—His Majesty's—Post Office Department and to explain to them the wonderful little gadgets which flashed intelligence across the space of the waters between Old England and the Emerald Isle.

The authorities, high hatted, of course, came and saw and marveled, but did not purchase. They were of the opinion that in spite of the fact that the English Marconi Company had never been able to even approximately duplicate the feat, the time was certainly near at hand when they would (particularly since a Yankee had shown them how) and in view of these circumstances it would hardly seem fitting for representatives of His Majesty's government to purchase American-made apparatus in preference to home-made products. So they desired to wait a time and hold the matter of the DeForest Company's offer under advisement. They would let the London representative of the American firm know of their decision shortly.

And in the meantime the Russo-Japanese war had made its entrance.

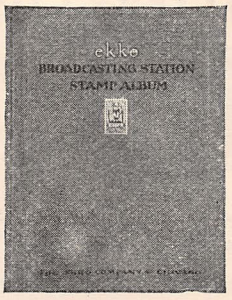
One of the assistants coming back from Dublin to meet the others and take passage with them had just enough money to pay his passage home. The London agent could not obtain any more funds from the home company in America, and so the operator simply fell to the best expedient under the circumstances. He went to bed in his inn and stayed there until DeForest called for him. He told them that if he had moved about he would have found it necessary to eat, and that if in the event he had eaten he would not have been able to remove his luggage from the inn to the boat.

DE FOREST MEETS LIONEL JAMES

On the boat once more they felt better, since they were headed toward home, and with the priceless satisfaction of knowing that once more, they had won—had accomlished the task they had set out from America to accomplish and had shown the Britishers a few Yankee tricks they could not equal, and had beaten them at their own game. The second day out they found that Prof. Reginald Fessenden was on the boat as a fellow-passenger—they were making the return trip on the *Majestic*, too—but he was not afire with cordiality, since he claimed that the DeForest Company had made pretty free with his electrolytic detector in equipping their commercial sets.

However, DeForest and Horton had found Captain Lionel James listed on the passenger roster. And while in London, DeForest remembered, he had read several accounts in the *Times* written under the name of this same James carrying the notation "our chief war correspondent, shortly to depart for the seat of probable naval warfare between Russia and Japan."

Immediately DeForest saw his chance. A word and a shilling to the steward changed his dining table to the same one to which Capt. James was assigned. Another visit placed their deck chairs adjacent. Before the journey was half done DeForest had Lionel James a thorough convert to the possibilities of wireless—the American DeForest wire-



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The stamps are beautifully engraved in different colors. Each station has its own stamp showing call letters. The album is 9½x11 inches, handsomely bound in a two color cover. It contains 96 pages with spaces for stamps of all recognized stations in the United States and Canada, arranged alphabetically by states and call letters. Contains also a convenient log and an alphabetical list of official names and other interesting features of call stations.

Think of how much fun you can have showing your friends your album and proving to them at once how many stations you have heard. And think of how much more fun you'll have collecting the stamps themselves. Most of the important broadcasting stations in America are already furnishing Ekko Stamps to their hearers. Although the game is still new, over 25,000 radio fans throughout the country are already enjoying this fascinating hobby. Many Ekko Album Owners already have more than 100 stamps pasted in their books.

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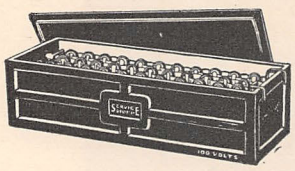

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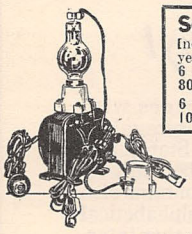

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Charges 6-volt A or Auto Batteries or up to 125-volts of B Battery IN SERIES. Easy to use. Noiseless in operation. Very efficient.

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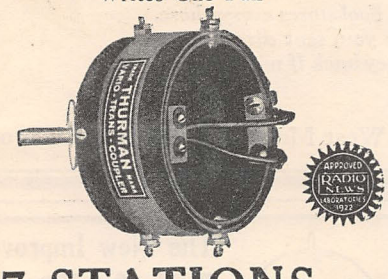
42 DX STATIONS

IN ONE NIGHT ON A

THURMAN COIL

Writes One Fan



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Send 2c stamp for free hook-up or send $5.00 and your dealer's name for coil and hook-up. Money refunded if it isn't the best you've ever used.

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Balloon Aerial for peak reception on the week-end, etc. Period of flight 18-24 hours. Price complete, $5.00 plus postage. Shpg. wght., 3 lbs. Includes instructions, large reel, hydrogen apparatus with calcium chloride drying tube and three 30-inch pure rubber balloons. **Everett Scanlon, Lakewood, R. I.** Has been approved for experimental purposes

less. Fessenden did not have a chance to even make the acquaintance of the famous war correspondent. Before the boat had passed quarantine James had concluded preliminary arrangements for equipping his dispatch boat in Japanese waters with wireless telegraph apparatus from which he might send his dispatches to the cable office on shore. He was headed for Port Arthur and judged that, from the conditions existing at the time, an independent observation post would probably be the safest.

James was also to cover the coming conflict for the *New York Times*. The London and the New York papers got together. Capt. James had no time to spare; he took a train immediately for Seattle, but not until he had thoroughly "sold" his wireless idea to Mr. Hooper, New York representative of the *London Times*.

Hooper and the business men of the DeForest Company then concluded the arrangements. DeForest was to equip the boat, furnish the operator and the land station and set the whole arrangement in good working order and keep it in that condition. In return, the papers would meet all the assembling and dismantling expenses, the salaries of the operators and a fixed rent for the use of the apparatus. DeForest did not have any spare apparatus. There was only one course. He immediately cabled Cornish—Cornish had been an assistant during the Holyhead-Howth tests—to take the apparatus used there out of storage and to bring it along with himself to New York by the first boat. Cornish did it—with the aid of a helper and many bottles of stone ale. James had not been gone 10 days when Cornish arrived. Two of DeForest's most trusted operators, Pop Athern and Harry Brown, were placed on a chartered express car filled with equipment and started for Seattle and the Orient. They just caught the last ship from Seattle, which would reach Yokohama before James left on his boat for a three months' cruise. Within a week after their arrival the shore station was being erected. At the Chemung, China, end the only available material out of which the masts could be constructed was bamboo. The operator found a likely looking Chinese coolie boss and put him to work running up the masts. The difficulties seemed very great. Within two weeks gas engines were started and the press reports of the Russo-Japanese War were being forwarded through the apparatus of the American DeForest Wireless Telegraph Co.

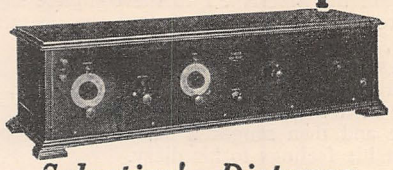
A NEW RECORD MADE

While his first assistants were thus getting the war correspondent's view of life, DeForest himself was learning how the Pilgrim Fathers felt when they had to arise in the early morning and light fires in the huge fireplace in a room 15 degrees below zero. He was at the tip of Lake Erie erecting a station. The spring was late and the weather bitterly cold. The masts had been raised and the engine installed. Here, as at most of the stations, a second-hand engine was used to drive the generator furnishing the alternating current for the transformer. On the cold mornings they invariably refused to work. This was the case at the Erie station.

Another station was installed at Cleveland, 180 miles west along the lake shore. After cutting through 18 inches of frosted ground to install the earth plates, and after countless delays, the Buffalo station was put into operation. It worked beautifully. The 180 odd miles of ground and water lying between the two stations were bridged and the company had broken another record for long distance transmission. It was the greatest overland distance ever covered by wireless telegraphy up to that time, 1904.

This success was partly due to the installation of a complete tuning arrangement at the receiving ends. This consisted of two

Here's The Set For Real Radio Reception



Selective! Distance Without Distortion!

The Terlee Acme Reflex Receiving Set represents the last word—the **best** word in radio service. Read this evidence and use your own judgment. A Terlee Acme user in Philadelphia writes: "With local station on air at 395 meters, I received Cleveland at 390 meters without interference." Another user in Chicago living two blocks from WLS (345 m.) received Springfield, Mass. (337 m.) without interference. Still another Chicago user gets Cincinnati (309 m.), Oakland (312 m.), Long Island (316 m.) and Buffalo (319 m.) without interference. Four Terlee Acme sets in middle west have authenticated European reception. All of the results stated above were **secured on loud speaker with loop aerial!** Scores of others report similar results. If you want selectivity with distance but without distortion from an easy-to-tune set, get a Terlee Acme Reflex Receiving Set—there's nothing like it on the market. Results talk! And the Terlee Acme is a live conversationalist! Ask your dealer. If he cannot give you full information, write us sending his name.

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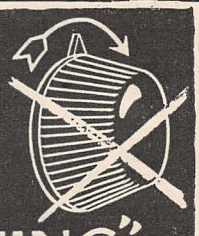

No more guessing and uncertainty as to your tube filament voltage. AMPERITE inside your set, one for each tube, automatically gives just the right current to bring the most out of every tube. Simplifies wiring and operation. Increases set compactness. Lengthens tube life. Tested, proved and adopted by more than 50 set manufacturers. The set you buy or build will not be up-to-the-minute in effectiveness without it.

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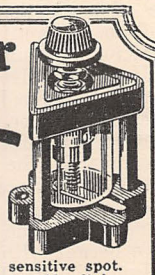

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For base or panel mounting, complete with Freshman Super - Crystal **$1.50**

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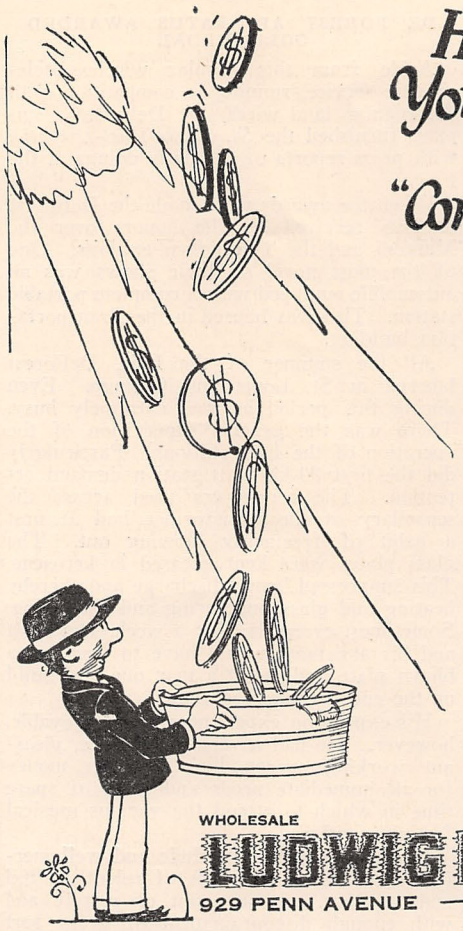
double slide tuning coils in electromagnetic relation. One of them served as the aerial inductance and the other as the secondary inductance. (See the accompanying illustration.) This was the first real adaptation of adjustable tuning to commercial radio apparatus. The principles of tuning had been known since the classical experiments performed by Hertz, but the various experimenters in the practical branch of the art had never until this time discovered the real value of the adjustable tuned circuit, or how to take practical, operative advantage of that principle.

EXHIBITION AT ST. LOUIS WORLD'S FAIR

After the success of this overland operation, in view of the glowing reports of the success of the apparatus on the *Times'* war excursion, DeForest decided that several demonstrations at the St. Louis World's Fair would be fitting, and ought to be profitable.

So, as soon as spring made its appearance, DeForest and assistants went off toward St. Louis. The concession space was granted and they started the erection of the several stations. One was installed on the center level of the observation tower, the tallest structure on the exposition grounds, housed in a glass house so visitors would have a perfect view of all the working parts in actual operation. A second station, of 20 kilowatts power, which was to be far ahead of anything heretofore attempted, was placed next to the Boer War exhibit. This installation served as the high-power apparatus and established two records that lasted for a long time. After endless failures and other setbacks, this station was opened in September, 1904, and constant service was maintained thereafter with Chicago, Kansas City and Springfield, Ill., all during the time of the Fair. The record was the transmission and dependable reception of overland



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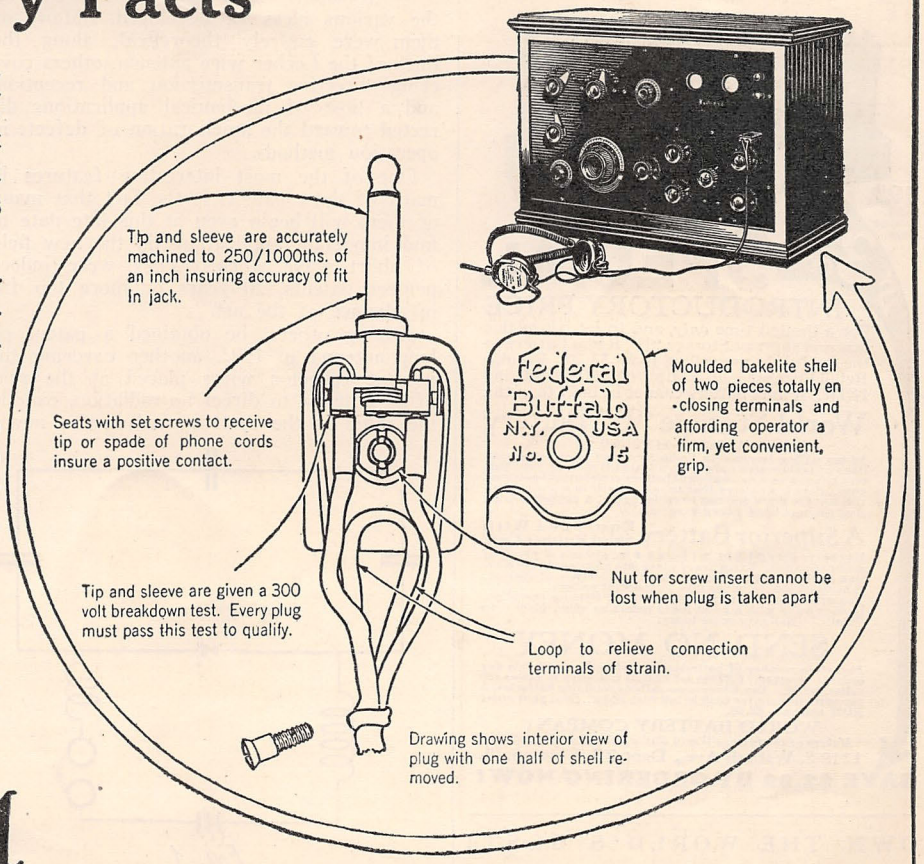

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10 DAYS FREE TRIAL *Coast to Coast*

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Description: 5 tube set. Comes completely assembled in beautiful mahogany cabinet, size 25x7½x7½. Has 2 stages Tuned Radio Frequency, Detector and 2 stages Audio Frequency. Equipped with the highest quality, approved *standard low-loss parts*. Genuine Bakelite Panel. Bakelite dials. Use any standard tubes and batteries.

10 DAYS' FREE TRIAL

Don't miss this chance to buy this high grade 5 tube set direct from factory. Regular value $100.00. Our factory price **only $38.50. Send no money.** Sign and mail coupon. Pay only $38.50 when delivered, (plus small transportation charges). Try it 10 days. If you are not delighted with results—if you do not consider it equal or better than any $100.00 set, send it back and we will cheerfully refund your money.

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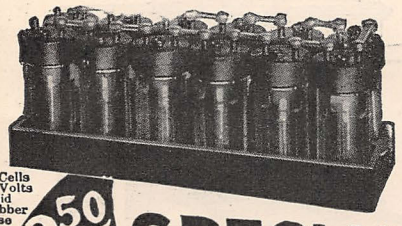

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A *Superior* Battery Equipped With Solid Rubber Case

Has heavy duty 2 1-8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and seepage of current. It holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Mail your order today.

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messages over 300 miles. Nothing like it had been done up to that time.

DE FOREST APPARATUS AWARDED GOLD MEDAL

Aside from this regular wireless telegraphic service, running in competition with the regular land wires, the DeForest Company furnished the *St. Louis Post-Dispatch* with press reports of the daily doings at the Fair.

When the awards were made the DeForest exhibits received all the honors over the Marconi and the Telefunken exhibits. One of the most novel of their shows was an automobile equipped with a complete portable station. This was housed in the Transportation building.

All the summer of the Fair, DeForest labored in St. Louis and Chicago. Even during this period he was extremely busy. There was the general supervision of the operation of the Fair stations. Particularly did the first 20-kilowatt station demand attention. The condensers used across the secondary of the transformer had at first a habit of frequently blowing out. The glass plates were kept encased in kerosene. This suppressed brush discharge and thereby heating and glass puncturing and shattering. Sometimes, every day for a week, DeForest and his assistants would have to tear out a blown plate and insert a new one and build up the entire condenser anew.

His exposition experiences were enjoyable, however. He had a very good home, pleasant working surroundings, enough money for all immediate needs and a bit of spare time in which to attend the various musical festivities offered.

It was a pleasant interlude and well merited after the four years of relentless toil and sacrifice, without stint or respite and with enough discouragement of every sort to test the stamnia of any pioneer.

HERE we must digress. During the years following 1899, DeForest had constantly been taking out patents on the various ideas he developed. Many of them were entirely theoretical, along the lines of the Lecher wire antenna, others covering directive transmission and reception, and a host of mechanical applications directed toward the amelioration of defects in operation methods.

One of the most interesting features in many of these patents is the fact that many of them will begin even at this late date to find important applications in the new field of short wave work. They were indeed pioneer patents, 20 years or more too far in advance of the art.

Among others, he obtained a patent on loop antenna in 1902, another covering the present reflector wires placed at the rear of an antenna to direct its radiation, exactly the same as the system used in the newly

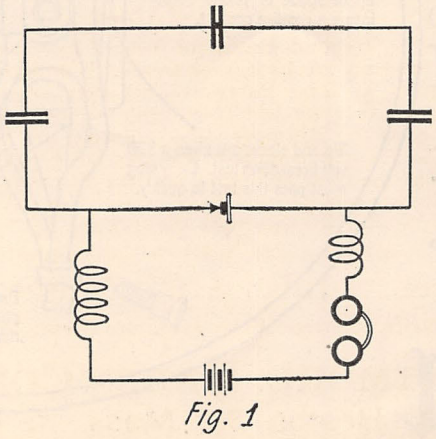

Fig. 1

DeForest's patent covering the loop receiving antenna. The condensers were employed to place the detector at the voltage peak.

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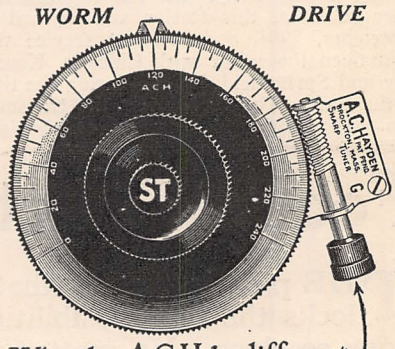

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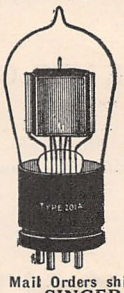

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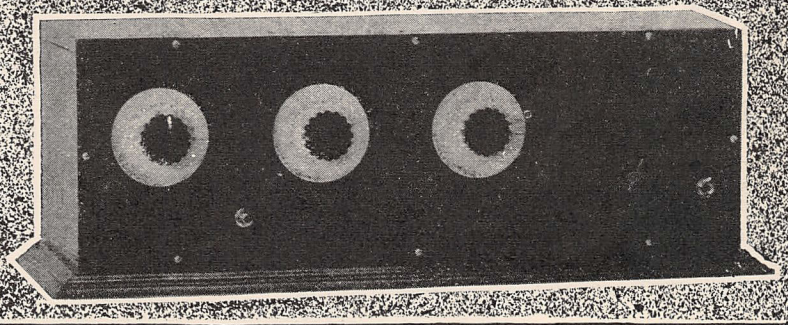

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OTHERS SAY:— "It never disappoints"—"Beyond doubt the best I have ever seen"—"By far the most powerful four-tube set we have seen yet"—"Wonderful results for the summer"—"We have tested at least thirty-five different receivers . . . however, we have determined to get a receiver which will give us the desired results, and so far we have found it only in the Biltmore"—"Absolutely the best receiver which can be had at any price"—"Have had quite a few sets but I have never had any which has had anywhere near the clear reception that the Biltmore has"—"I am inclosing a list of seventy-eight stations which I have received to date on the Loud Speaker (I do not use phones) with the Biltmore Four-Tube Set."

Names and addresses on request.

Prices: 4-tube, $100; 5-tube, $125

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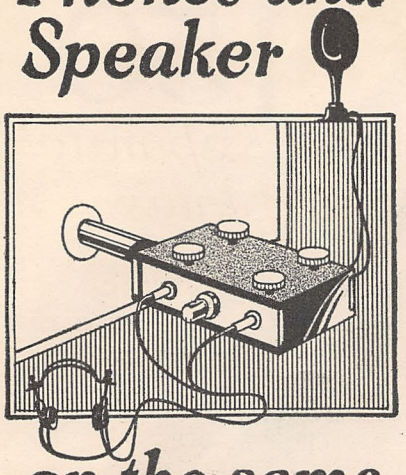
Boston 30, Mass.

Phones and Speaker



on the same plug—

One plug now serves for *both* phones and speaker. Both are permanently connected—and the handy switch shifts reception from one to the other instantly! A big step forward in plug design! You'll wonder why you ever put up with inconvenience of two separate plugs!

MAR·CO SWITCH PLUG $1.00

announced Marconi beam transmitter. DeForest applied for this patent in 1902, and it was issued in 1903. A third patent covering a break-in system for simultaneous transmission and reception was filed about the same time.

In Fig. 1 we have shown what was possibly the first commercial adaptation of the loop antenna for reception. The peculiar placement of the three condensers around the loop is such that a voltage peak is forced at the detector, thus giving the highest possible input for the receiving set. The conductors

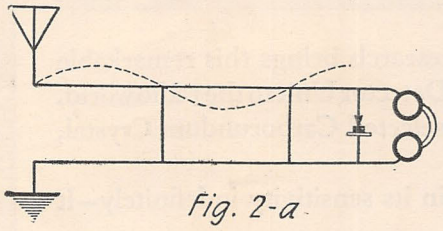


Fig. 2-a

The first step in the Lecher wire development. This may be important in the new ultra short wave work.

were placed on a large frame just as they are today.

Each of the sketches in Fig. 2 represent an adaptation of Lecher wires for receiving. The underlying principle of this idea was, of course, known before DeForest worked it into the form contained in the patent. The

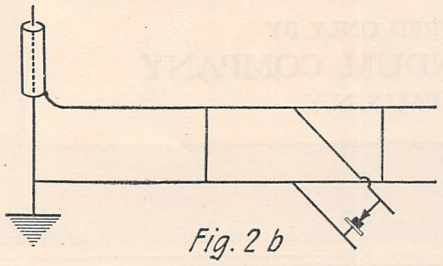


Fig. 2 b

The second development. Detector position changed.

bridges at certain positions on the wires made the circuit tune so sharply that all interference could be cut out by the method. The only trouble was that a long wave receiver of this type—300- and 400-meter waves as were being used at the time—would have to have reached almost from the Woolworth building to the Battery in order to complete the tuning apparatus. DeForest made the adaptation shown in the diagram

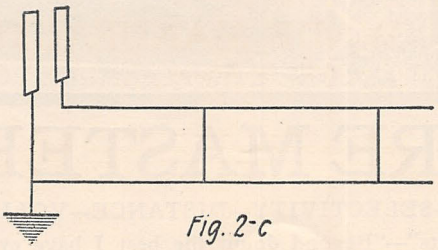


Fig. 2-c

A third adaptation using plate antenna.

of Fig. 2 and attempted to wrap the twisted cables around a cylinder. The distributed capacity of such an arrangement was, of course, high and large dielectric losses would have prevented its functioning efficiently. Much of the advantages gained by the sharp tuning would have been lost through the diminuation of signal strength due to the too large distributed capacity.

SYSTEM FOR HEATING THE ANTENNA WIRES

One of the inventions belonging to the mechanical branch was that shown in Fig. 3, a joint patent by Lee DeForest and Walter Clark. Practical operating experience had taught DeForest that a very small storm only was necessary in midwinter to cast the

Improve that Radio Set with the X-L Vario Denser

Model N the Ideal neutralizing condenser for neutrodyne or radio frequency sets. Cap. 1.8 to 20 M.M.F. .....$1.00 Each

Model G .00016 to .00055 M.F. range, for positive grid condenser capacity in any set. Complete with grid leak mounting. $1.50 Ea.

Write for circular with endorsements of Prof. G. M. Wilcox, Armour Institute, F. D. Pearne, radio editor Chicago Herald & Examiner, and many other radio authorities describing advantages.

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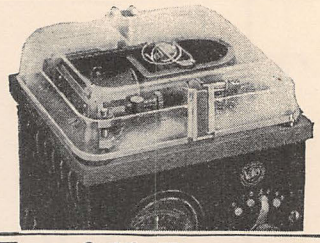

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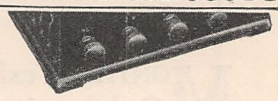

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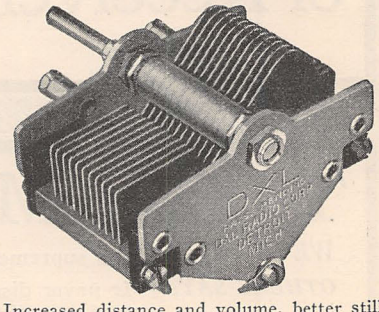

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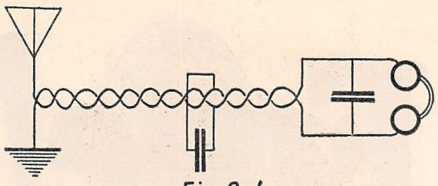


Fig. 2d

The parallel wires adapted to twisted cable.

best laid plans of the station in the discard through breaking down the aerial with a load of ice. After experiencing this difficulty a few times, he evolved the system shown. By using a step down transformer of a very large ratio and throwing the whole supply of the generator directly into the antenna the wires could be kept warm enough to prohibit the formation of ice with very little difficulty. The same system is employed today in some of the large trans-Atlantic stations during the winter. Long before the device was in practical operation, DeForest and Clark obtained a patent on it. Afterwards, when its use was licensed to the Radio Corporation, it developed that the method had been surreptitiously used for a number of years previously by the Marconi

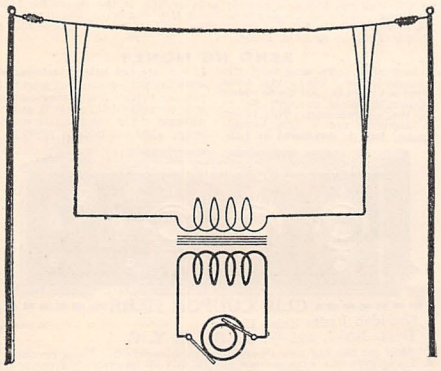


Fig. 3

DeForest's method of keeping antenna clear of ice and sleet. The generator delivers power to heat the wires.

Company, naturally without due credit having been given to the inventors.

SYSTEM FOR HANDLING LARGE CURRENTS

At Fig. 4 we see the first of the great number of systems designed to control large amounts of current from the operator's key. As the art was making constant advances, larger and larger powers were called into service. Each time more kilowatts were added to the transformer input, another difficulty presented itself in the method to be employed for making and breaking the current. Of course, relays were tried and in many cases used. However, their addition to the set tended to complicate the apparatus

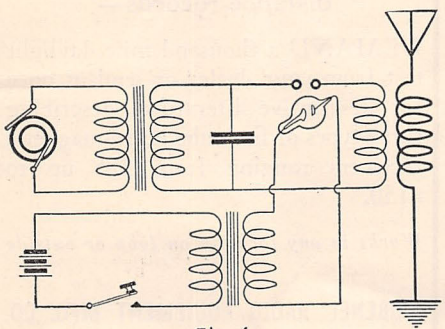
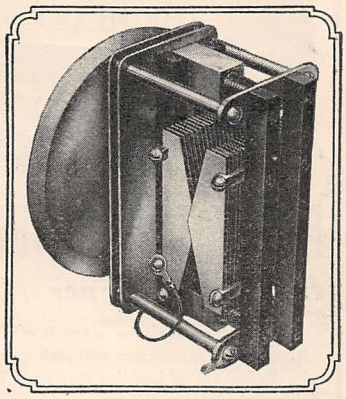


Fig. 4

The ray trigger device for keying high powered spark sets.

Frame grounded separately from plates

WADE
SQUARE LAW
CONDENSER UNIT



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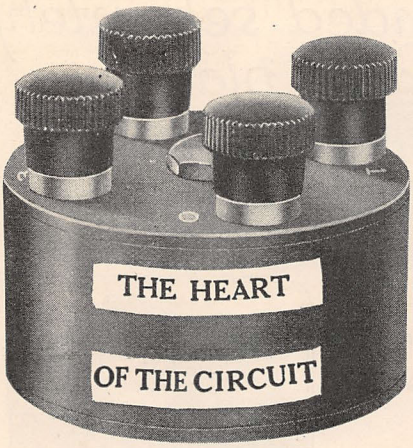

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already under the control of a single operator, and in order to keep the station so it could be efficiently handled by one man, DeForest fell to finding ways and means of making the current without the addition of relays.

He used an ultra-violet light to "trigger" or control the spark. He had found in previous experiments that a gap could be so distanced that under ordinary circumstances the current would not pass it, but that a violet light would ionize the air, thus decreasing the resistance to the passage of the current. Such an arrangement is shown herewith. The vacuum tube was keyed and the spark followed the rays. The only trouble with the device was that, once started, the spark tended to continue, in spite of the extinction of the violet light. It made sending very unsteady.

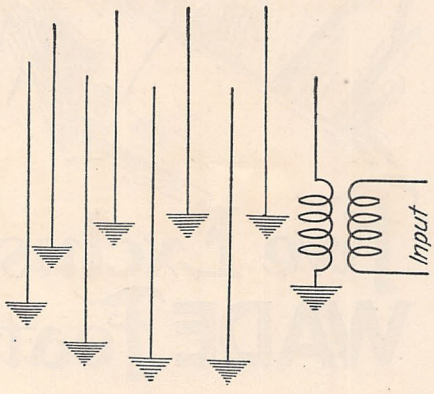

Fig. 5

DeForest was first to work on the beam principle. This patent drawing shows it.

At Fig. 5 is given the sketch from DeForest's original patent on the beam transmission. It is exactly the same as that employed today. The reflecting wires are arranged in a parabolic curve back of the transmitting antenna with the vertical antenna in the focus.

There were many others. In fact, everything from an oil break key to synchronous spark telephony. There were more than thirty—thirty-four, to be exact—granted him in the four years. Future trend of the radio art will tell with what far-sighted discernment his inventive faculties operated during those pioneering years.

(*To be continued*)

The Significance of Rays in Physics

(*Continued from page* 1670)

diffused wave without any definite wavelength. In a sound analogy it could be likened to noise. The characteristic ray shows after reflection from a quartz grating which bends it into a definite line spectrum. This line spectrum is analogous to the well-known spectrum of visible light. I give, as an example, the Balmer series produced by the impact of the cathode rays against the atoms of the element out of which the anti-cathode is made. The electrons are lifted out of the innermost spheres, *i.e.*, from near the nucleus, and are driven further from the nucleus, thus changing their plane of energy. The gaps thus resulting in the inside spheres are again filled, since electrons in the higher spheres are dropped back to the planes of less energy. And since this drop is accompanied by a release of radiated power, X-rays result. The frequency of these radiations released follow the formula V=h/E.

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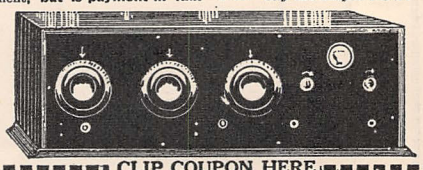

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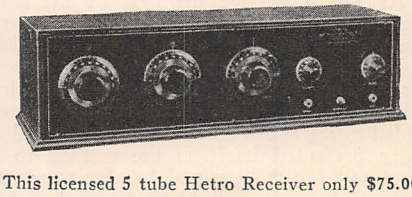

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of the theory—that the theoretically calculated value of the frequencies possible under the Bohr and quantum theory coincide with the observationally discovered lines of the high frequencies of the Roentgen spectrum. This high frequency series shows a specially clear and comprehensible structure and proves itself in relationship with the charge of the nucleus, as Mosley first recognized.

HYDROGEN AND OTHER ELEMENTS

We have seen in the case of hydrogen, the frequency of lines given by the formula $V=V_0\ (1/m_2-1/n_2)$ in which m and n denote integral numbers and so-called fundamental frequencies; V_0, following out the fourth law of Bohr, can be easily calculated from the charge of the nucleus and other universal constants.

In the case of other elements of other higher atomic weights, the relations of the optically visible spectrum to the structure of the atom becomes extraordinarily difficult to determine, as we have already noted, because the course of light of emission in the outer electron sphere varies and a frequency for the other electrons is not only determined by the charge of the nucleus, but also by the charge of the inner electrons.

The calculation of the frequency of X-rays is easily calculated since the emission of these rays comes about through the displacement of electrons near the nucleus of the atom. Consequently, the case is analogous to the calculations for the hydrogen atom.

Bohr's theory applies as well to visible spectrum as to the invisible one lying below the violet.

INDEPENDENT PROOF

Von Frank and Hertz arrived at a very impressive proof of Bohr's theory in an independent manner. As a matter of fact, they did not know that they were doing it while the experiments were in progress. It happened in the following manner:

They knew, of course, that the atom in the ordinary state of stability did not radiate energy, and that in order to cause it to do so, it was necessary to disturb the atom to impart energy from the outside which would force the electrons from the inner rings of less energy to the outer rings of greater energy and then allow them to fall back into their old tracks with the accompanying radiation of the extra energy absorbed when they originally left the courses nearer the nucleus.

The amount of necessary energy may be easily calculated from the quantum of Planck. This excitation can come about in very different ways, either by corpuscular rays, where the kinetic energy of the corpuscles is included with that of the atom, or else by embedding the existing atoms in an outer radiation field. We can readily accept this bombarding of atoms with electrons, and it is on this that Frank and Hertz built up their researches. If the velocity of the electrons, and accordingly their kinetic energy, lies within a certain sphere or shell, then these electrons projected from the outer sphere of the atom being simply elastic follow the laws of impact of ordinary mechanics and are reflected without losing any of their energy. The course of events would be far different if the energy of the impinging electrons reached the amount necessary for the excitation of the atom. Then the elastic impact of the two would change the elastic mutual impact into an unelastic quantum, would take from the stricken atom its supply of energy and give it to the striking electron, in the shape of the kinetic energy which was used for taking electrons from the inner spheres to the outer ones. The sphere—or shell—value which the energy of the moving electron must reach to be able to bring about the

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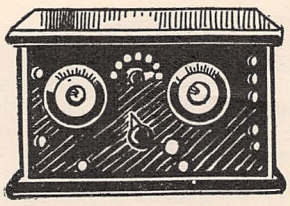

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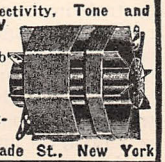

PATENTS

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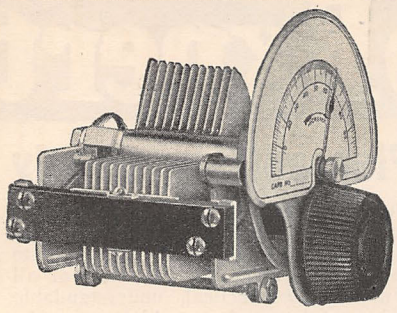

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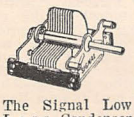

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light-emission of the spectrum line of definite frequency is theoretically given by the well-known relationship E equals $h\nu$. The velocity and, therefore, the energy of the moving particles is in very simple relationship to the potential difference, V, which they pass through, and this can be easily deduced from the sphere-value of the potential, where the light-emission of the stricken atom begins. Thus, for instance, electrons, which are made to excite mercury vapor to the emission of the characteristic violet line 2536, must at the very least have gone through a potential difference $V = 4.9$ volts, to be able to give the requisite excitation to the atom of mercury. Below this intensity of excitation no trace of these lines appears; this accordingly can be taken as a new proof of the Bohr quantum theory of the spectrum.

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We are now prepared to estimate the frequency V of single lines of the spectrum produced by a gas or a vapor, without needing optical spectrum apparatus, by a purely electrical calculation from the potential $V = h\nu$. Even the so-called ionizing potential can be determined by this very simple process.

If an energy greater than the initial energy necessary for the excitation of the atoms is imparted to the impinging electrons, we can definitely tear out or separate an electron completely from the atom, so that the atom deprived of one of its electrons becomes a positive ion. This process completes itself in close accord with the requirements of the quantum theory.

ANOTHER EXPLANATION

In our third article we alluded to the Fraunhofer lines in the spectrum of the sun. These lines appear as dark lines on a bright ground. The condition of existence of such absorption spectra finds in the Bohr and quantum theory its complete and definite explanation. For an atom to absorb light of a given frequency, V, the light reaching it must have a frequency v, which is great enough to give the necessary excitation, *i.e.*, $E = h\nu$ in the atom which is to absorb it. If the frequency reaching the atom is less, the atom acts with absolute indifference to the field of rays, and light energy of exactly the frequency v is the first which will be absorbed by it.

We see that the atoms are simply little particles that refuse absolutely to absorb light of any other than the correct frequency. If, instead of a gas, a solid or fluid body comes under our consideration, we see that the electrons embedded therein are much less particular in their choice, and can be drawn out of their fixed connection with the atom by light of all sorts of frequencies. But here we have to deal with the electric light effect, which we have learned about in the first article of this series, a well defined quantum law. The impinging light sets free from solid or liquid bodies electrons of a perfectly defined velocity, which is given by the expression $\frac{1}{2} mv^2 = h\nu$.

I hope that I have succeeded in giving the attentive reader a glance into the secret but strictly quantum relationships, which control in equal way the progress of the radiation of incandescent bodies, the subtle path of visible and invisible spectrum series; how the departure of atoms from solid bodies under the operation of light is controlled; in short, how all processes which rest upon an interchange of electro-magnetic radiation and matter are regulated.

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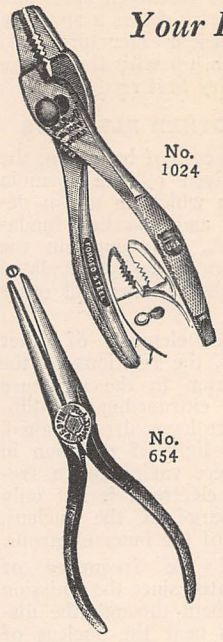

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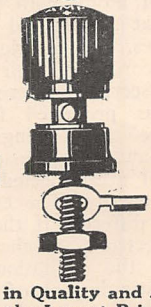

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Analysis of Condenser Resistance

(*Continued from page* 1669)

the center. As a result it creeps toward the surface of the conductor.

Resistance as defined above, for the uniformly distributed current, is known as the ohmic resistance, which depends only on the nature of the conductor and its dimensions. The effective resistance of a conductor, however, may be very different from this value, since it depends on the amount of heat generated in the conductor. It follows, then, that the effective resistance of a conductor "suffering" from skin-effect may be many times the ohmic resistance, and such is the case. The magnitude of the skin-effect is spoken of as the ratio of the effective resistance at high frequency to the ohmic resistance (at zero frequency), or in symbols, R/R_0.

The magnitude of this effect depends mostly on the dimensions of the conductor. Small wires have less skin-effect than large ones, although their ohmic resistance is considerably less. Skin-effect also exists to a marked degree in flat conductors, such as strips or tapes. There is no doubt that it also exists in condenser plates. Moreover, the effect should be greater in condensers which use the thicker plates. The magnitude of this effect will be discussed later on in this article.

SURFACE LEAKAGE

Any condition of the surface of the dielectric used in condensers which permits a leakage of current from one set of plates to the other also introduces losses which may be considered as representing an addition to the resistance of the condenser. The surface leakage in well-made condensers is not very large; in fact, it is so small that it may be neglected. The insulation resistance of a well-made condenser may be as high as several thousand megohms, and under the small voltages used in radio tuning circuits (a microvolt or two), it is obvious that no appreciable leakage will occur. The leakage, of course, depends also upon the hygroscopic nature of the material, that is, upon its ability to absorb moisture from the atmosphere or from other sources. Slight absorption of moisture will affect the surface resistivity considerably, but under ordinary conditions the effect of surface leakage on the resistance of the condenser will be negligible.

VOLUME LEAKAGE

Volume leakage represents the leakage of current through the body of the dielectric. Little need be said concerning this, as the remarks made above in connection with surface leakage apply equally well to volume leakage. It may be added for the benefit of some experimenters that temperature also has an effect on these qualities, but it likewise has a negligible effect on the resistance of a well-made condenser.

RESISTANCE OF SURFACES IN CONTACT AND SOLDERED JOINTS

The resistance of surfaces in contact, as between plates and washers of a condenser, is negligibly small, as compared with the total resistance of the condenser. The same may be said about the resistance of soldered joints, as in condensers with plates soldered into the supporting posts, or where the pig-tail is soldered onto the rotating shaft. It is difficult to conceive that these resistances are even large enough to measure, so it can hardly be expected that they would contribute appreciably to the resistance of a condenser. There is one place, however, where appreciable resistance is encountered, and that is at wiping contacts in condensers which do not have pig-tails. The resistance

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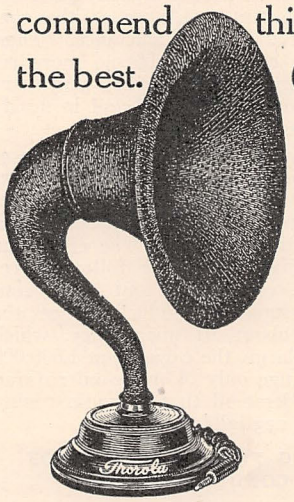

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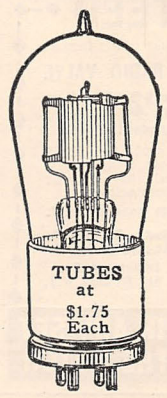

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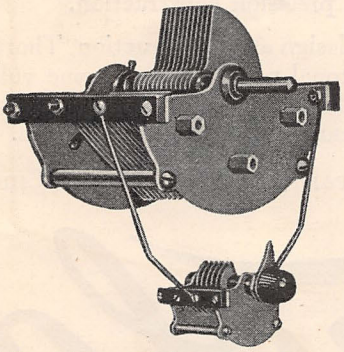

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of this joint is extremely variable, depending upon the nature of the surfaces in contact, and the condition of these surfaces with regard to moisture, grease, etc. Under any conditions a pig-tail is a worthy addition to a condenser.

It has been thought by some that a pig-tail raises the effective resistance of a condenser because of its inductance. This is not so. Inductance in *series* with a condenser raises the apparent capacity somewhat, and makes it variable with the frequency, but does not affect the resistance in any other respect than adding to it in series the resistance of the inductor. A small capacity in *parallel* with an inductance increases the apparent resistance of the inductor by reason of the capacity, but an inductance in *series* with a capacity does not change the apparent resistance of the condenser by reason of the inductance. Thus, a pig-tail in a condenser adds no more resistance than its own resistance, which undoubtedly is exceedingly small and in nearly all cases can be neglected.

Theoretically, the capacity of a condenser changes by reason of an inductance, such as would be furnished by a pig-tail, in series with the condenser. But how much it changes is another question. The effect can be easily calculated with the following results: If we consider a .001 mfd. condenser and assume the inductance of the pig-tail to be about .01 microhenry, which is ridiculously large, the capacity at 1,000,000 cycles will change only .4 micro-microfarad It is easily understood that in radio tuning circuits this is negligibly small.

MEASURING THE RESISTANCE OF CONDENSERS

Now as to the actual resistance of condensers and a word as to methods of measuring their resistances. Numerous variations of several methods have generally been used up to date, but investigation has disclosed the fact that few, if any, of these methods gave reliable results. It is interesting to note that many experimenters who have used these methods, and who have published results of measurements made by these methods, have never thought to check up the accuracy of their measurements by the simple process of measuring a known resistance. In other words, first measure the resistance of a condenser at the desired wave-length or frequency, and then measure the resistance of the same condenser (at the same dial setting) in series with a short piece of No. 32 (or smaller) manganin wire. The difference between these two measurements, if the method used is correct and accurate, will be the resistance of the wire, which can be checked by an ordinary D.C. measurement on a Wheatstone bridge. This check is subject to several variations, according to the whims of the experimenter.

Most of the methods used, at high frequencies, give the total resistance of a measuring circuit which includes a coil of relatively high resistance, and the condenser to be measured or a standard condenser. The resistance of the standard condenser, specially constructed for the purpose, has often been supposed small enough to neglect; in other words, to call zero. The error encountered by this assumption is greater than is generally supposed. Common sense tells us that no piece of electrical apparatus can be constructed to have zero resistance. Furthermore, as will be shown later, there are other resistances in condensers besides dielectric absorption, which is all that the experimenters attempted to avoid in constructing these standard condensers. The objection might be raised that the Bureau of Standards has gone to great lengths to construct special condensers with quartz or pyrex insulation. This is done because these condensers are often used in making meas-

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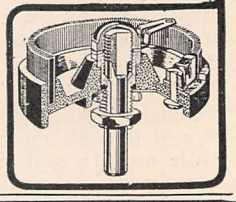

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urements at low frequencies, under which conditions dielectric absorption is a serious matter.

A few methods of making the measurements directly at the high frequencies have been used by many experimenters, but even in cases where no standard condensers were used whose resistance was assumed to be zero, great inaccuracy resulted from the fact that the total resistance of the measuring circuit was not low enough. This may be explained in simpler words as follows: In all these methods the result obtained is the total resistance of the measuring circuit, including the condenser being measured. After obtaining this, the resistance of the circuit excluding the condenser resistance, must be subtracted, leaving the condenser resistance. Thus, if the measurements show the total resistance of the measuring circuit to be, say, 1.5 ohms, and the resistance of the same circuit excluding the condenser is, say, 1 ohm, the condenser resistance will be

$$1.5 - 1.0 = 0.5 \text{ ohm.}$$

Now, if an inaccuracy of one-tenth of an ohm is made in the determination of the total resistance (1.5), this would represent a precision of

$$\frac{0.1}{1.5} \times 100 = 7 \text{ per cent. (roughly)}$$

An error in the value of the condenser resistance (0.5) of 0.1 ohm would mean a very much lower precision, viz.,

$$\frac{0.1}{0.5} \times 100 = 20 \text{ per cent.}$$

Thus, an error of 7 per cent. in making the measurements would mean an actual error in the resistance of the condenser of 20 per cent. which is rather large. It is, therefore, necessary to keep the resistance of the measuring circuit as low as the resistance to be measured (the condenser), and everyone is acquainted with the difficulty of building inductances, which must be used in the measurement, whose resistance is very low and at the same time accurately known.

As a result of the objections to the prevailing methods of making measurements of condenser resistance, the writer, in conjunction with Mr. Chas. N. Weyl, of Philadelphia, devised a method* in which the inaccuracies of the other methods are reduced to negligible quantities. The method of checking the accuracy explained above was applied, indicating that the measurements could be regarded as correct to within 0.01 ohm. The measurements were made directly at radio frequencies, without the use of any standard condenser or any assumptions that could not be justified experimentally.

Measurements of condenser resistance at low frequencies, such as 1,000 cycles are of no value in radio. If all the resistance of a condenser were attributed to dielectric absorption, then measurements at 1,000 cycles could be used to calculate the resistance at 1,000,000 cycles, for the resistance *due to absorption* decreases in the same proportion as the frequency increases. However, since the skin-effect is negligible at 1,000 cycles, and increases very rapidly as the frequency increases, it follows that the total condenser resistance would bear no such simple relation to the frequency. Resistances at radio frequencies computed by assuming an exact proportion between resistance and frequency give ridiculously low resistances for the condenser as will be seen from the following.

The resistance of a condenser was measured at 1,000 cycles and found to be 278 ohms. Now, assuming the direct proportion explained in the preceding paragraph, the resistance due to dielectric effects would be at 1,000,000 cycles

*See Proc. I.R.E., Vol. 13, No. 1, 1925.

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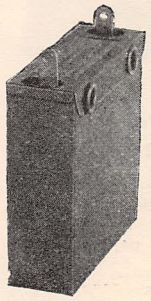

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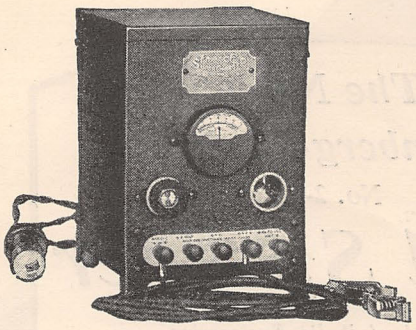

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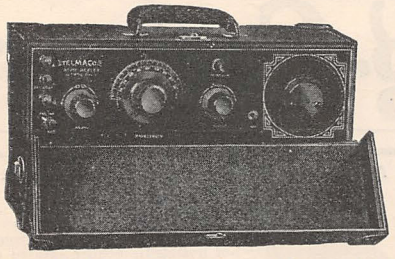

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or approximately 0.3 ohm.

The resistance of this condenser, when measured at 1,000,000 cycles by the new method, was found to be 0.8 ohm. The difference between the two, or a half ohm, is due to the skin-effect in the plates. In other words, in this particular condenser, over 60 per cent. of the total resistance is due to skin-effect, while less than 40 per cent. is due to dielectric losses. We are, of course, neglecting the other small items listed above, which have been stated to be very negligible. It is hardly likely that the resistances of surfaces in contact, soldered joints, surface and volume leakage can be more than about 0.01 ohm, which is the precision of the measurement.

The magnitude of the skin-effect was found to be even greater than this in some condensers. This gives rise to the following interesting thought. Since most condensers have about the same size and shape plates, and are made of materials differing very little in ohmic resistance, and the greater part of the resistance is due to skin-effect, it follows that the resistances of nearly all the condensers on the market cannot vary very much. Experiment has shown this to be so. The majority of the condensers, including both the low-loss and the old style types, had resistances slightly less than one ohm.

Casual inspection of some of the condensers also supports this view of the subject. Some condensers of the old style type which had comparatively low resistances, were found to have thin plates. Other condensers of the low-loss type whose resistances were comparatively high, were found to have thicker plates. This point may be of interest to designers of condensers, but the writer wishes to remind them that the evidence pointing toward this is not conclusive. Further experimentation along these lines is suggested. The idea, however, is consistent with the known fact that the skin-effect in flat conductors having their large surfaces adjacent increases rapidly as the thickness of the conductors is increased.

Larger condensers have lower resistances than smaller condensers. Moreover, the resistance of a condenser remains low and nearly constant with the dial setting, until a setting of about 25 or 20 on the dial is reached, at which point the resistance begins to increase very rapidly. At five or ten on the dial, it may be as high as 20 ohms, even in a condenser of the low-loss type (see Fig. 2). This is very serious, and it follows that condensers should not be used at low dial settings. Since this is the case, we should not care hereafter what the minimum capacity of the condenser may be, for we should not use the condenser near the bottom end of the dial. The inductance coils in the tuning circuits should be so designed that the wave-length range can be covered without tuning low on the condenser dial. This will necessitate a slightly larger condenser, and a slightly smaller coil, but the increase in efficiency will be considerably increased, since we are not only using the condenser at positions of low resistance, but a smaller coil has likewise much lower resistance than a large one. The reduction in the resistance of the circuit, allowing a much greater current to flow (for a given voltage) will more than compensate for the decrease in voltage across the inductance coil as a result of reducing the value of the inductance.

We have always been told to use the greatest amount of inductance possible, so as to obtain the greatest voltages possible on the grid of the tube used in the radio set. The voltage across the inductance, however, is a function of the current in it, and

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if this is kept low by reason of high resistance, we shall be no better off by reason of the higher inductance. It will be found that with proper coil design the resistance can be *more* than cut in half when we build a coil of half the inductance. Furthermore, low resistance coils of high inductances are too large, so generally better results will be obtained with coils of lower inductance of proper design. More will be said about this in a succeeding paragraph.

In connection with the variation of resistance with the dial setting of a condenser we may point out here the advantage of the low-loss condenser, that is, the condenser which has the lower resistance at a dial setting of 100. It would be expected that the resistance of condensers having higher resistances at 100 on the dial would increase more rapidly as the plates are turned out than would be the case with condensers of lower resistances at 100 on the dial. The difference in resistance between the two types is not large, and the most important thing to consider in a well made condenser is its mechanical construction. Of course, we are not considering condensers that are not worth using.

In connection with fixed condensers, it is surprising to note that these, as a rule, have as low resistance as the air condensers. This is surprising because we have always been told that condensers with solid dielectrics show considerable absorption. However, we must remember that most fixed condensers are small, meaning that they have small, thin plates. The skin-effect is, therefore, reduced considerably. It is probable that the skin-effect is reduced as much as the absorption effect is increased by the use of the solid dielectric. This may account for their low resistances.

The average reduction of resistance from the old style type of condenser to the low-loss type is about ¼ of an ohm for the 0.0005 size, and about 2/10 of an ohm for the 0.001 size.

An interesting thing in connection with the test is the result of measurements made on a condenser when uninclosed and when enclosed in a metal container. The resistance of the condenser was increased by the container or shield by as much as from 20 per cent. to 50 per cent., depending upon the size of the condenser. This seems to indicate that some of the gain expected in condensers which have eliminated the end-plate of insulating material, and replaced it by metal end-plates may be offset by losses due to the formation of eddy-currents in the metal end-plate, and may at the same time be another reason why the resistances of all the condensers did not vary much. About 200 condensers were measured, representing 60 different makes; the highest resistance obtained was about 2 ohms, and the lowest about ½ ohm. As said before, the average resistance of them all was less than an ohm.

It must not be forgotten that while dielectric losses decrease as the frequency increases (or as the wave-length decreases), eddy-current losses in metal end-plates and other parts of the metallic structure increase. This may seem to indicate that condensers with metal end-plates may be less efficient at the ultra-short wave-lengths than those having end-plates of dielectric material. However, there is reason to believe that the losses in the end-plates are small as compared with the losses in the condenser plates themselves, and also that there may be an optimum wave-length at which the resistance of a condenser will be least. As the frequency increases dielectric losses decrease while skin-effect increases. At extremely high frequencies, the skin-effect may increase faster than the dielectric absorption decreases, so that up to a certain frequency

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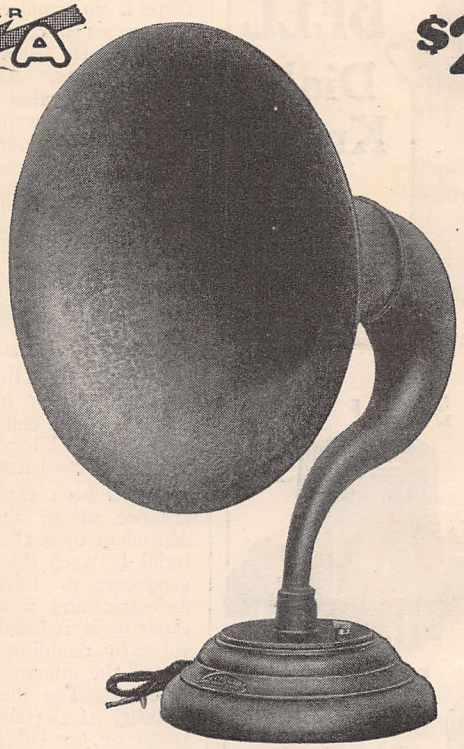

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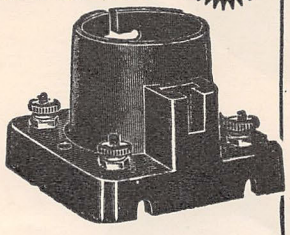

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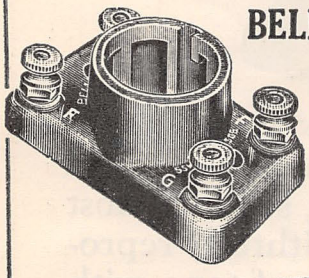

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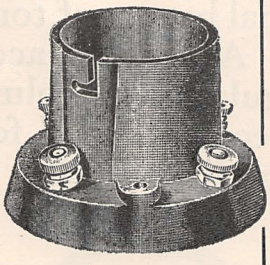

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the condenser resistance would decrease, beyond which it may rise again.

It was found in these measurements that there is no simpler relation between the resistance of a condenser and the frequency, as has been heretofore assumed by many experimenters. As explained above, many have thought that the resistance of a condenser decreases in the same proportion as the frequency increases. It has been customary to express the quality of a condenser by its phase difference, or power factor, for it has been found that when the losses in condensers are due *mainly* to dielectric absorption, this power factor or phase difference remains constant. Without going into the theory of the thing, the power factor may be expressed by the formula,

$$\psi = 0.36\ frc$$

in which ψ is the phase difference angle or power factor in degrees, (r) is the resistance of the condenser in ohms, (f) is the frequency in kilocycles and (c) is the capacity of the condenser in microfarads.

It has been explained above that the resistance of an absorbing condenser is not dependent upon the amount of dielectric material between the plates. Suppose a given condenser to have a certain amount of dielectric and a certain capacity. If the capacity is reduced to one-half the original value by doubling the distance between the plates, the amount of dielectric used will be doubled. The dielectric absorbs a certain quantity of electrical energy *per cubic centimeter* or *per cubic inch* so that the amount of energy absorbed will be doubled. In other words, the resistance (due to the absorption only) will be doubled.

Since the resistance has been doubled and the capacity has been halved, it follows that the power factor, which involves the product of these two, will remain the same for a given frequency or wave-length. It has been on this assumption that the resistance of a condenser has been so often regarded as inversely proportional to the frequency.

If, on the other hand, there is further variation of the resistance (r), due to skin-effect, it follows that the power factor cannot remain constant. This fact has been substantiated by the results of the measurements, which have shown that in the range of frequency from about 1,000 kilocycles (300 meters) to about 1,500 kilocycles (200 meters) the resistance varied inversely as the 0.76 power of the frequency, or, in symbols,

$$r \propto \frac{1}{f^{0.76}}$$

This ... the law of variation for one particular condenser. It is likely that this exponent will be different for different condensers and also over different ranges of frequency. At any rate, the simple inverse relation has been disproven.

For the benefit of those who may feel inclined to question the accuracy of these measurements, in spite of the check measurements that were made, there is another proof of the validity of the method which is conclusive as the check measurements. Quoting from Circular 74 of the U. S. Bureau of Standards, page 196, "For a variable air condenser with semi-circular plates having a small resistance mainly due to dielectric absorption in the separating insulators, the resistance is inversely proportional to the square of the setting, at constant frequency." The curve in Fig. 2 showing the actual variation of the resistance with the dial setting has been plotted on logarithmic co-ordinates in Fig. 3. The upper part of the curve turns out to be a straight line, having a slope of —2, showing exact agreement with the above quotation. In other words, for the small dial settings, at a constant frequency or wave-length,

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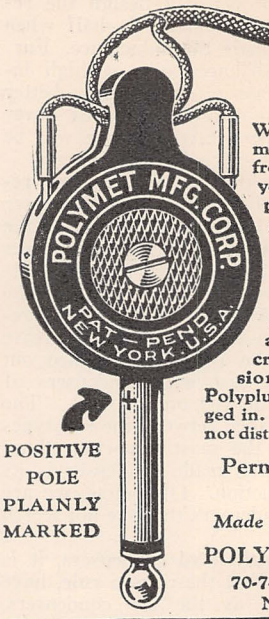

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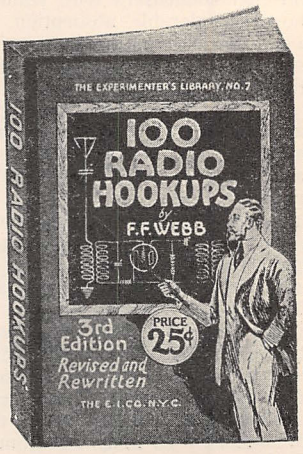

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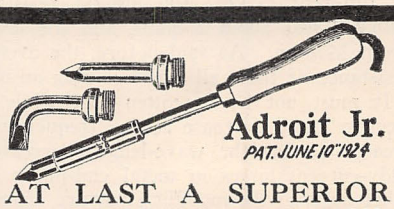

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$$r \propto \frac{1}{D^3}$$

However, if we should assume the only losses in the condenser to be those due to absorption in the dielectrics, the point where the dotted continuation of this straight line cuts the ordinate for a dial setting of 100 will give the dilelectric loss at this frequency and at a dial setting of 100. In this particular case it happens to be 0.09 ohm.

It will be remembered that the resistance of this condenser measured at 1,000 cycles is 278 ohms, at a dial setting of 100. If now we again assume the whole resistance of the condenser to be due to dielectric absorption, the dielectric loss at 100 on the dial and the same frequency (96 meters or 3,125 kilocycles) that applies in the above paragraph (and to Figs. 2 and 3), it will be

$$\frac{1{,}000}{3{,}125{,}000} \times 278 = 0.09 \text{ ohm}$$

which agrees exactly with the value obtained before.

We have thus determined the dielectric losses both from the viewpoint of variation with dial setting and variation with frequency, and the values obtained are in exact agreement. Furthermore, the measurement of resistance at 1,000 cycles was made by an uninterested party, viz., the Bureau of Standards.

In this particular condenser, therefore, the dielectric losses at 96 meters are only equivalent to 0.09 ohm, while the total resistance of the condenser at that wave-length is 1.25 ohms (see Fig. 3). The dielectric loss, therefore, is only 7 per cent. of the total condenser resistance.

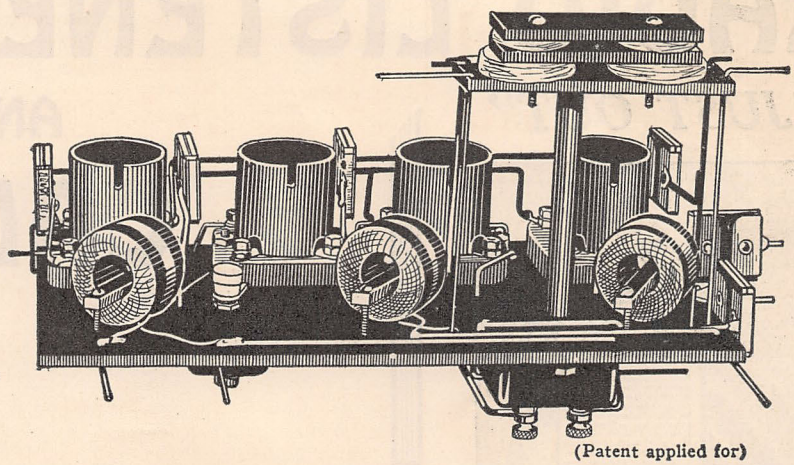
It is well here to make a comparison of the resistance of condensers and the resistance of coils used with them in tuning circuits. For some reason or other, coil manufacturers have not been advertising the resistances of their coils like the condenser manufacturers have been doing. It is generally known that the resistance of coils runs very high. In fact, the writer has measured the resistance of a 100-turn concentrated inductance and has found it to be about 60 ohms. A loop antenna recently measured had a resistance of 35 ohms at 300 meters. If we should take a 2-ohm condenser out of the circuit containing the 35 ohm loop and replace it by a 1-ohm condenser, while the improvement in the condenser would be 50 per cent., the improvement in the total resistance of the circuit would be less than 3 per cent. This comparison will show up much worse than this with some coils.

[*A detailed discussion of the various factors entering into the high frequency resistance of coils by the writer was given in the January and February issues of* Radio News. —*Editor.*]

The Navy World Wide Radio Net

(*Continued from page* 1628)

was begun in 1911, but it progressed very slowly, too slowly, in fact, to win any recognition from the Department heads immediately. In 1916, however, the commercial work began to develop radio seriously and the Navy used several sample sets, weighing 100 pounds or less, which transmitted about 100 miles while the plane was in flight. This was the first serious effort made to apply long distance radio to aircraft. During the war this work went along so rapidly that it could not be carefully notated. At that time the small but highly efficient radio laboratory in connection with the naval air station at Anacostia was established, and it



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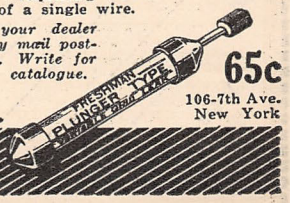

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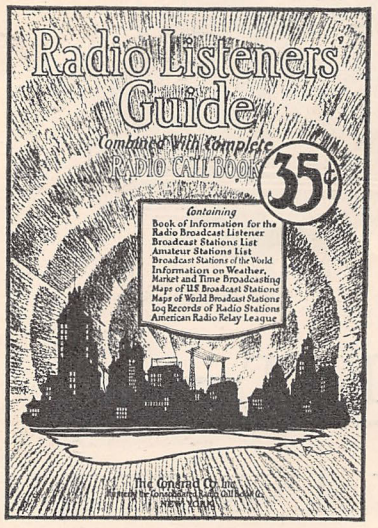

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DEVELOPMENTS

Among the important radio developments of the Navy has been the apparatus for enabling planes disabled on the water to transmit messages, thus making it possible to report to shore its position and by compass bearings from shore fix accurately its own position.

It is well to go into detail relative to the piloting cable spoken of elsewhere in this article. This device, which was perfected entirely by the Navy for the purpose of assisting in the efficient operation of aircraft, is laid in the vicinity of a flying field and is capable of giving out an audible signal. Take, for example, any air mail route between the east and west coast touching Chicago. This cable can be laid anywhere stretching 15 miles or more from Chicago west. A plane flying in the direction of Chicago from the west obtains its course automatically by flying over the cable, which gives a signal audible in the plane. It will guide the plane in a fog or darkness to the flying field, where a cable at right angles will give out a different sounding signal, informing the pilot when he should start his glide to the landing field.

Some interesting and beneficial discoveries are expected of the new Naval Research Laboratory at Bellevue, D. C. In order to concentrate all research at the one point, the Radio Research, Bureau of Standards; the Aircraft Laboratory, Anacostia; and the sound research section of the Engineering Experiment Station, Annapolis, Md., have been consolidated and are now a part of the Bellevue establishment.

The personnel at the Bellevue Laboratory consists of radio engineers, radio aides, sound experts, sound aides, laboratorians and draftsmen.

The Navy looks upon radio in the flying sense the same way dispatchers of trains look upon the telegraph. Weather forecasts are flashed twice daily, and radio sets in the planes receive further advices on long flights. As in England, Navy planes are already beginning to aid weather predictions.

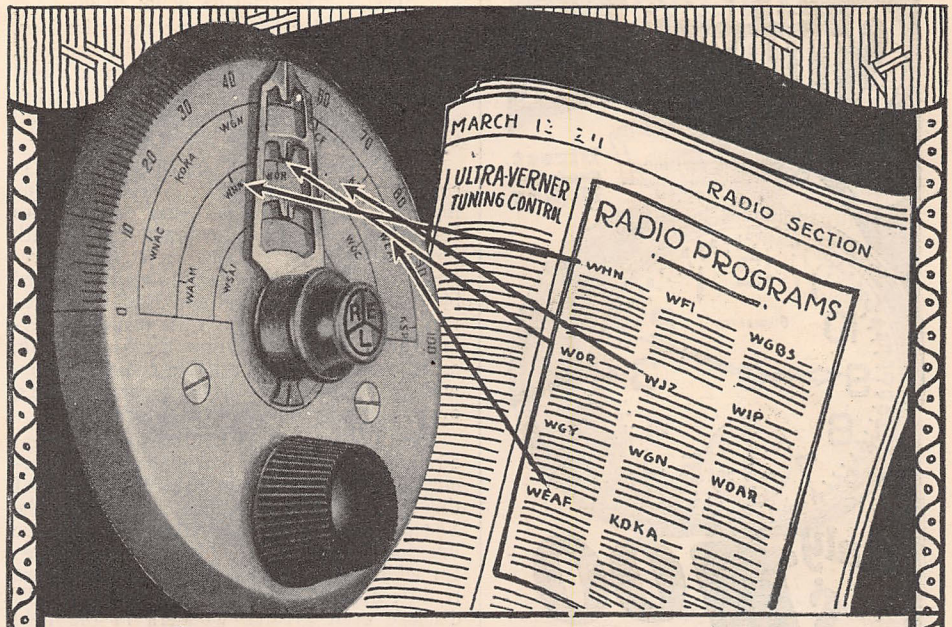
The United States Weather Bureau looks forward to the time when airplanes will supplant the more cumbersome balloons and kites now used.

IN THE AIR SERVICE

Had it not been for radio, the recent successful trans-continental flight of that mighty Queen of the air—*The Shenandoah*—might have been a failure. During the entire flight the ship was in constant communication with radio stations, and it even successfully broadcast on a regular schedule. The ZR-3 also maintained reliable communication on her trans-Atlantic flight.

In this regard Captain Ridley McLean, director of Naval Communications, has this to say: "Both our dirigibles in their recent flights navigated with assistance of radio bearings, and in the case of the *Shenandoah* it appears that navigation in the fogs on the West Coast was made possible through these compass bearings. Notwithstanding this development since 1911, aircraft communication is in its infancy. Reliable means of inter-communication between planes in flight and from planes to ground and vice versa are still to be devised and perfected."

The report of communication activities of the *Shenandoah* on her long flight is interesting. That vessel has not yet taken her place as a unit of the fleet, and the entire flight was of an experimental nature. It had been planned for her to use the ordi-



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nary channels of communication without any special arrangements being made.

As it later developed, her communications, most of which were with inland stations, proved to be not so much a test of the Naval Communication System as a test of her ability to maintain communication at all times with the various inland stations.

The Commander-in-Chief, U. S. Fleet, in comment upon communications during this flight, emphasizes the necessity of dirigibles becoming proficient in communicating with government radio stations on standard frequencies. Noteworthy results were obtained by the *Shenandoah* and the Radio Laboratory at Bellevue on high frequency. During almost the entire cruise, the *Shenandoah,* on 90 meters, was in reliable communication with the laboratory at Bellevue, at 50 meters, every night for about seven hours.

Even the layman can realize to what great advantages radio can be applied. A thorough study of the resumé on the wonder of the day, the trans-continental flight of the *Shenandoah,* would make the most inactive imagination active. With all these things for which radio is responsible to show, there is little doubt but that the next 14 years will disclose even greater wonders in the field of radio than the last 14 years have uncovered.

Survey of Progress in Radio Engineering

(*Continued from page* 1633)

direction instead of all directions. This important advantage, which means reduced cost, will probably not be fully realized because the great ratio of transmission in the desired to undesired directions is probably reduced as the wave spreads out to great distances. The undoubtedly great directivity for relatively short distances from the transmitting station, however, offers highly important advantages in another particular, the reduction of interference caused by the transmitting station.

One of the principal means of overcoming interference between the transmissions from simultaneously operating radio stations is obviously the increase of selectivity or narrowing of the band of frequency which each station uses. Progress in this direction is being made in all the various types of transmission, as, for example, through the use of filtering devices for radio telephony and coupled circuits in spark apparatus. The principal advance, however, is the increasing adoption of continuous-wave transmission for radio telegraphy.

We also have the advent of strictly constant frequency systems. A striking means of accomplishing this is furnished by the piezo-electric oscillator. A new radio communication system of the utmost selectivity and precision is made available by this new device, and services which require the operation of a large number of transmitting stations spaced as closely together as possible in frequency and taking full advantage of C.W. transmission will find this a great improvement.

The various causes of interference divide into two great classes, natural and man-made. As to the natural interference, there will always be a certain residum of atmospheric disturbances and fading which will limit the distance at which reliable reception will be possible. The various kinds of man-made interference, on the other hand, are curable and are of local character; it can be expected that more and more localities will be freed from the various types of this pest.

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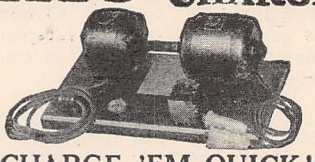

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Should Ground House Lighting Circuits

(*Continued from page* 1680)

out that grounding reduces the danger of fire and accident by preventing the occurrence on the circuit of voltages higher than expected, such as might result from lightning or from crosses with a high voltage line.

Grounding to water piping systems is considered by far the best where such systems are available, and the objections sometimes urged against this procedure are considered unimportant. Such objections include the likelihood of electrolysis, the danger to employes, and the possibility of overheating the pipes. There is, however, no evidence showing that these objections are valid.

Grounding of electrical circuits to gas jets should never be made, he states, as such pipes do not have freely conducting joints and the gas they contain is, of course, a nonconductor. Where water piping systems are not available, recourse should be had to artificial grounds consisting of driven pipes, rods or buried plates. Where soil conditions are not suitable for artificial grounds, the use of a system ground wire is suggested. To maintain grounding connections properly, systematic inspection and testing are recommended.

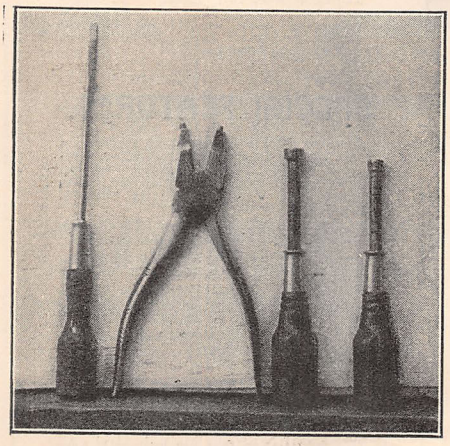
The grounding of secondary circuits may be made either at the transformer or at the building entrance of the service, according to the local regulations. Grounding at both places is recommended, thus insuring a multiplicity of grounds on every secondary circuit. The grounding connection at the transformer should be installed and maintained by the power company, while the grounding connection at the service entrance is installed by the building owner or contractor.

Some Super-Heterodyne Notes

(*Continued from page* 1667)

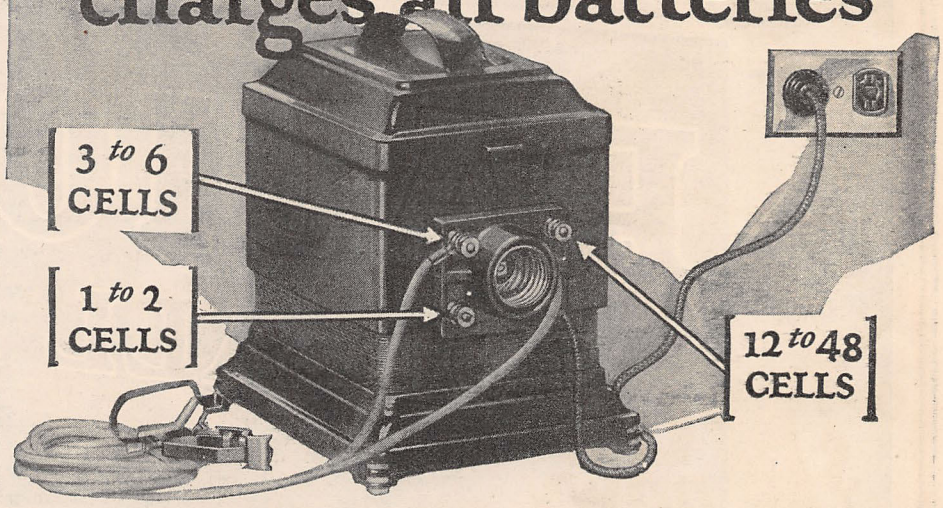
best, in my opinion, being the method known as the Super-Heterodyne. We see, then, that a Super-Heterodyne is nothing more than a radio frequency amplifier added to a standard circuit, and some method of boosting the incoming signal to a predetermined value before it strikes the final detector. Neither difficult nor complicated, is it?

Now as to the building of this amplifier: You may do one of two things—pass the signal from the first tube to what is called the input transformer, or filter, or you may pass everything which comes to the first tube through the amplifier and then filter out the signal wanted. In either case a second detector picks up the signal handed to it and passes it along to the telephones or audio frequency amplifier just as it did in



The tools the author recommends in the construction of Super-Heterodynes.

New Model Tungar charges all batteries



On the back of the Tungar, there are three terminals. Slip the wire into one and charge your radio "A" battery, 2 or 4 volt size. Use the second to charge your radio "B" battery, 24 to 96 volt size. Or the third will charge a 6 volt "A" battery or 6 to 12 volt auto battery.

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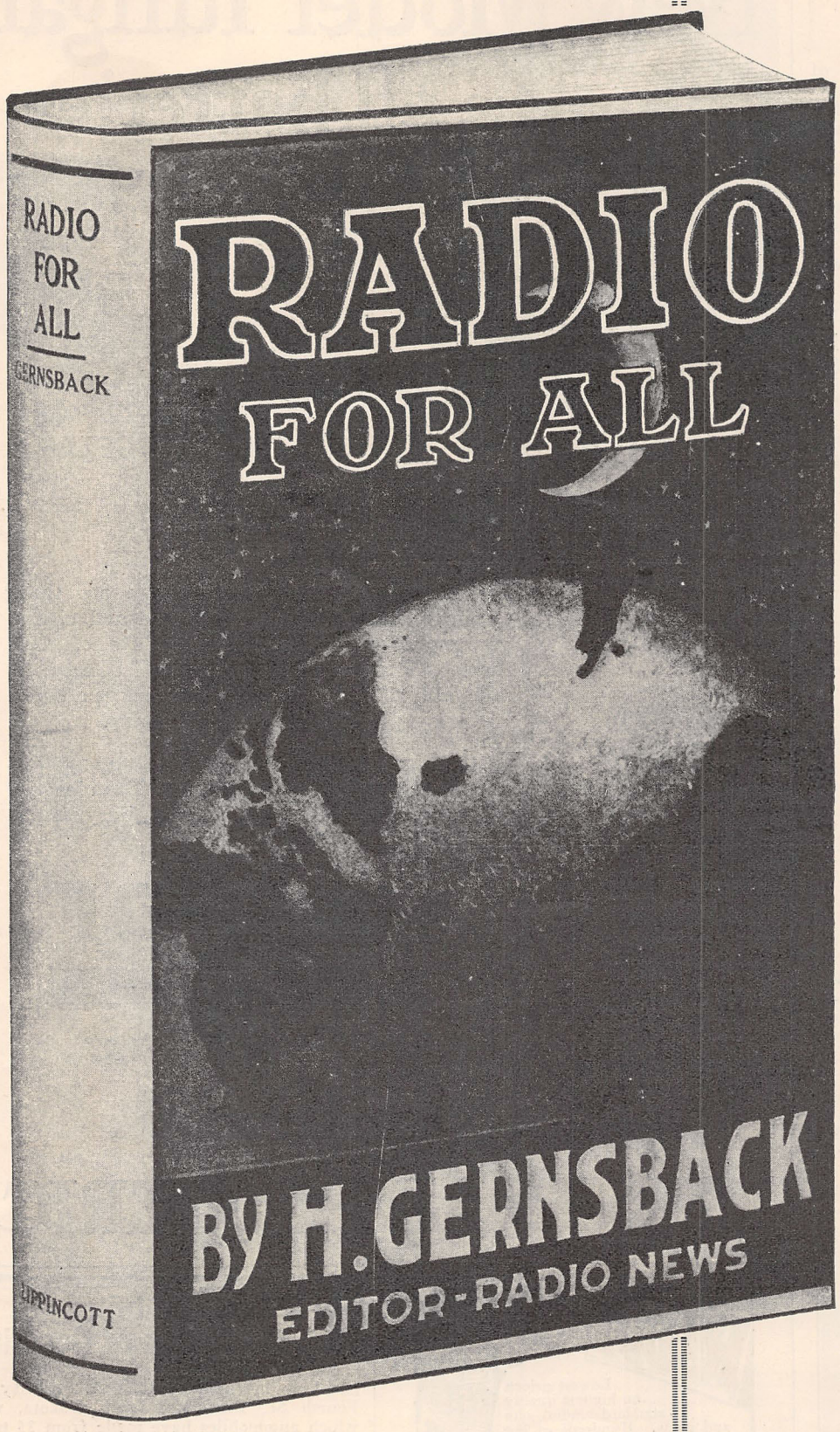

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the simple tuner, except that the signal the second detector gets has been magnified tremendously, and the audio amplifier has a good fat signal to work on instead of a puny little one.

Whichever method you use, it is a good stunt to measure the height of the transformers and then mount the sockets on a shelf of this height so that the grid terminal of the transformer will be on a level with the grid terminal of the socket as shown in Fig. 5. You will thus be able to have the grid leads less than an inch long, and the centers of the transformers will be much further away from the centers of the tubes—a very desirable combination. Screw this shelf to the table about two inches to the right of the condenser panel; make it out of a dry wood strip 30 inches long, ½ inch wide and ½ inch thick. Mount sockets four inches on centers; there will be room at the

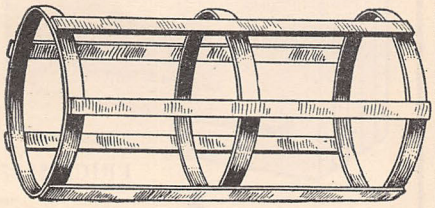


Fig. 2

Form that the tuner is wound on.

right end for audio tubes if you wish to use it for that purpose.

I'm not dishing out any theory in this veracious chronicle—you can look over back numbers of RADIO NEWS and get more of it than any ordinary man can digest—so I will leave it to you to decide what transformers you will use. I have used five different makes and wave-lengths, including my own (which were rotten), and they all have their points of superiority; shut your eyes and grab the first one you touch—it will do the trick. The one used in this last Old Sleuth of mine is 3,000 meters (100 k.c.), and I think it is as satisfactory as any.

If you use an "input transformer," put a good variable condenser across the primary, and vary it until you get the best results. The circuit diagrams are all alike, with minor variations, and are very easily followed. If you use an output filter, this may be nothing more awesome than a choke coil, but it will have to be wound to take care of the particular transformer you are using; this is a nuisance and I doubt if it is worth the trouble.

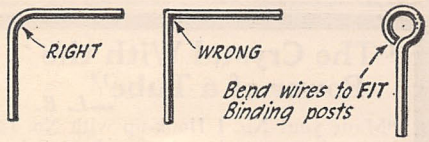
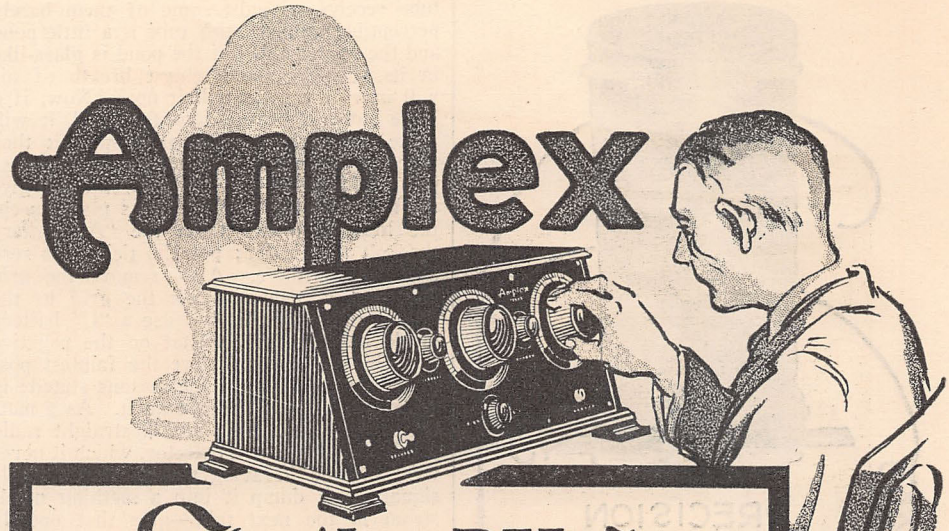


Fig. 4

The correct method of bending wire.

The oscillator is not given enough attention in most of the sets I have seen. It is only a device for making a row, I'll admit, but it cannot function properly if it is junk. Use a standard commercial coil—the particular winding used is not vital—and wire it up with as much care as you use on the rest of the set; hook it up to the other condenser, keeping it as far as possible from the first tube, and you will have completed the job. Now, however, comes in the fine "Eyetalian" hand of the lad who is looking for something a bit better than the good ones!

Almost every hook-up one sees calls for 45 or 90 volts on the plates of all the tubes. Consider, if you please, just what these various tubes are supposed to do. The first



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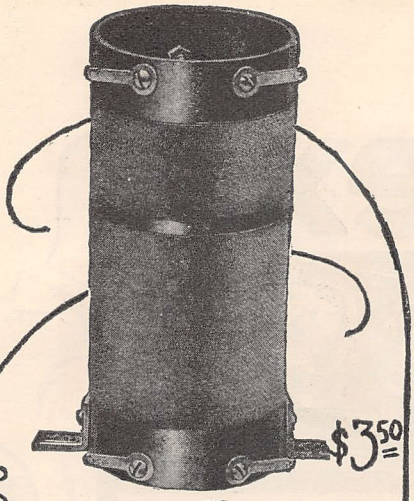

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tube receives signals, some of them barely perceptible; suppose this tube is a little pond and the grid a cork; if the pond is glass-like in its stillness, the slightest breath of air will move the cork, will it not? Now, if a large stone is heaved into the pond, it will make the cork bob furiously—will it then perceive the faint breath of air? Not so you could notice it! Therefore, don't give the first tube *any* battery on its plate except the little it draws from the "A" battery through the tickler; put the tickler at zero and keep it there. Also, remove the grid leak and condenser, hook the grid to the negative leg—and do *not* use a "C" battery or do not put the rheostat on the negative leg—this grid should have the faintest possible negative bias for the reasons stated; in other words, keep the tube quiet. As a matter of fact, you now have a straight radio amplifier instead of a detector, which it never was, anyhow. Having picked up the feeble signal, don't dump it into a seething mäelstrom in the next tube—give that one 16 volts, the next one 22, the third 35 and the detector (fifth tube), 22. Give the oscillator not more than 22, the first audio 45 and the second 90, if this seems best. We use entirely too much plate voltage on all our tubes in my humble opinion; give each tube its own "B" battery—and as little as possible at that; this will give a vastly more sensitive receiver, remove the unwanted communication between tubes and, incidentally, cut down battery expense because they last much longer.

Any audio frequency amplifier may be used with a Super-Heterodyne from a Western Electric power house to a resistance coupled affair. My present favorite is one stage of transformer (3½ to 1 ratio) and two of resistance; this delivers volume and freedom from distortion *in itself;* if WBZ is buzzing, as usual, you cannot eliminate the buzz.

This is an expensive set to build and an expensive set to run, but it is the simplest to build and much the simplest to operate—

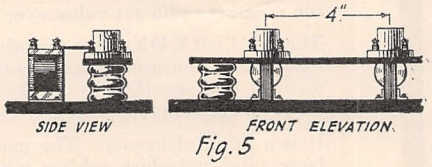


Fig. 5

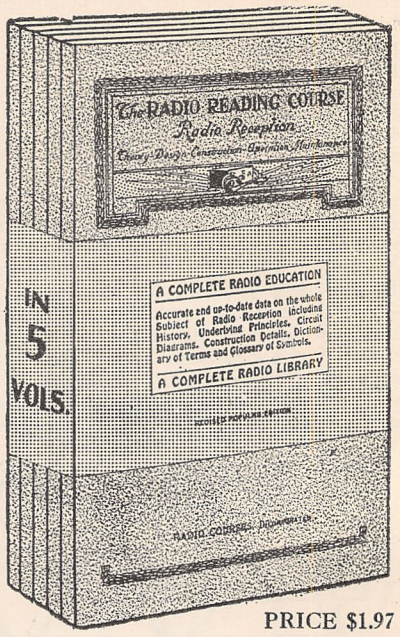
Method of mounting tubes on shelves to shorten wiring.

and I have constructed many kinds. Reflexing and second harmonic stuff reduce the number of tubes, but if a fellow wants a Super-Heterodyne, why build a makeshift? Cutting out one tube is like cutting out one cellar window in a half million dollar house—you'd never note the saving. You cannot get something for nothing, nor can you hope to sidestep any of the responsibilities of a multi-tube set and expect to get results comparable to those given by the set with a full complement of vitals.

Put in all the fixed condensers called for by the diagram you use and then take them out, one at a time, and see just what they do (if anything). You will find that no two circuits respond alike, and that you may have to vary the placing and values of the fixed condensers considerably.

And tubes! Ninety-eight per cent. of all Super-Heterodyne troubles are due to the poor tubes dumped on the market. No two of them have the same characteristics and many of them will not function at all in this circuit. If you have any trouble, suspect the tubes *first*; change them all about until you find the best combination, and then mark them. After you get the tubes balanced, the set will work like Old Dog Tray; Old Faithful isn't in it for reliability.

Last, but not least, if you must have a cabinet, see to it that it is ample in size—



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that the instruments are two inches from the sides of the panel, and if your location is at all damp, use kiln dried oak soaked in hot paraffin for base, shelf and box.

I cheerfully admit all the shoutings about static and noise levels and what not, but when there is static of more than normal severity *no* receiver is a DX getter and *no* loop will relieve it; but when reception is good—um! Well, I'm glad I own the original of the go-getter I have told you about—it brought in French ESP on the night of November 24, when darned few in this country got 'em!

The Future of Radio

(*Continued from page* 1643)

The cost of such intercommunication is much higher than is ordinarily thought to be the case. No one is at present in a position to judge truthfully whether the charges asked for long distance and local interconnection service are or are not justified on the basis of engineering costs, but it is evident that these facts must be determined in the very near future.

A second method of delivering nation-wide service is to interconnect radio stations by radio. The Westinghouse Electric Company has developed a system of intercommunication by short waves or high frequencies which almost ceases to be an experiment and becomes a commercial possibility. This system is used to broadcast simultaneously from their three large stations located in Springfield, Mass.; Pittsburgh, Pa., and Hastings, Nebr. The Westinghouse Company deserves much credit for the amount of creative effort which it has expended on this project.

The third method of delivering nation-wide service under active study is the establishment of one large powerful station of from fifty to two hundred kilowatts power which will, because of its great power, reach all portions of the country. I will not discuss this project in detail, but only state that in my opinion it is less likely to develop into the ultimate solution of our problem than the other two. In any case, however, we can expect that the delivery of nation-wide programs will become a frequent occurrence, and this phase of radio broadcasting will come to be an integral factor in our national life. Of no small magnitude is the task of seeing that this great agency of enlightenment does not become a tool for the dissemination of organized sinister propaganda.

The most pressing problem in the radio broadcasting field today is undoubtedly the question as to what agencies will ultimately control broadcast stations and who will pay for broadcasting. It is easy to say that broadcasting must ultimately be paid for by those who use its services, but this statement is meaningless in view of the present remote connection between listener and broadcaster. We are much nearer a situation where the listener will directly control what is transmitted than a situation where he will directly pay for broadcasting. The 500 broadcast stations now in operation are owned and controlled by many types and classes of organizations, many of whom do not yet know just what their status will be in the ultimate solution, but they feel that their interest is so great that they must remain in the field until they find out just what that status is. As a result we find that there is a greater demand for broadcast station licenses than can be met by the use of the wave bands which can be assigned to this service. and most large cities find themselves with two or more high-powered stations owned by different interests each striving to outdo the other and hoping ultimately to have the field to itself. The ten-

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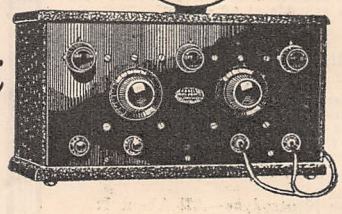

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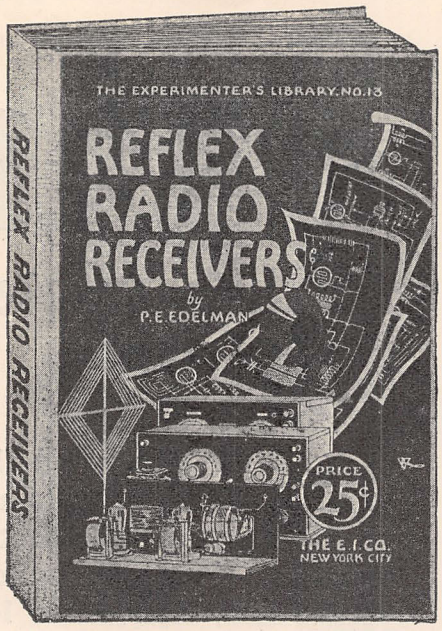

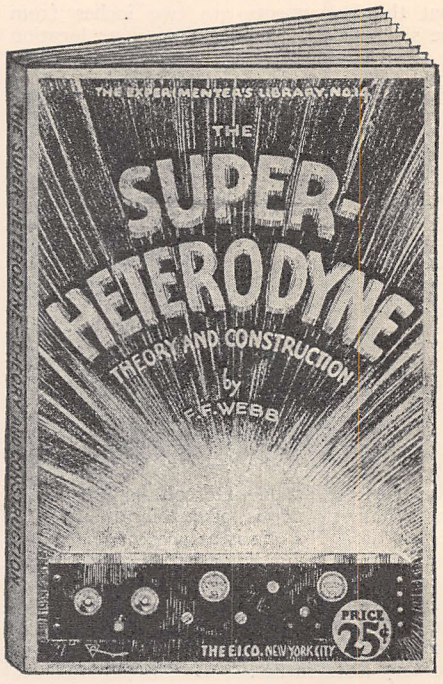

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dency at present seems to indicate that shortly high grade high-powered broadcast stations will either be a part of the chain owned by the large electrical companies or will be backed by large organizations whose business and interests are nation-wide. It seems evident that the engineering solution of the broadcasting problem of each large center of population will be the operation of united broadcasting service in that community on such a basis that the programs sent out will be representative of the interests of that community. If this is the economic as well as the engineering solution, I feel safe in predicting that it will ultimately prevail.

With this brief view of the problem as a whole, let us see how St. Paul and Minneapolis are progressing with its solution. After four years of experience we see the establishment of one large station with the united backing of Minneapolis and St. Paul, which is striving to make its programs representative of this community and the Northwest. I am not speaking in jest when I point with pride to the fact that these two cities so often outwardly hostile in their attitude toward each other have seen the logical and ultimate necessity of co-operating in this particular instance. That in itself is a tremendous accomplishment, but it was made necessary by the very technical nature of radio communication. We may safely state that this community is immeasurably nearer the solution of its broadcasting problem than any other large center of population in the United States because both cities have concentrated their efforts in support of the efficient co-operation of one good representative broadcasting service.

However, the problem does not end here. Now that the Twin Cities are united in their support of one broadcasting service, the next step is to make and keep this broadcasting service representative of the interests and life of the entire Northwest. To that end it is the duty of each and every one of us to offer encouragement where encouragement is needed, to offer constructive criticism rather than destructive criticism, and to see that no agency, commercial, governmental, or otherwise so hampers or restricts its activities as to any way prevent broadcast service to the Northwest reaching the high plane of economic and social usefulness to which it is destined.

If we conscientiously adhere to such a program as I have outlined above, we will not only have solved the broadcasting question for the Northwest, but will by example have taken the lead in placing radio broadcasting throughout the whole United States upon a sound economic basis.

International Radio

(*Continued on page* 1648)

expected that it will be received over a large area on crystal sets. The station will also study many phenomena as fading, and the influence of rarified air on radio transmission.

Aid to Conductors

Travelers on the trains of one of the railroads in France are to be notified of the next stop by means of loud speakers.

International Meeting

The International Committee for Wireless Telephony, which was founded in 1923, is planning to hold a great international meeting in Paris from April 16 to 20, 1925. Twenty-seven nations are repre-

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sented in this organization, which is in close relation with the League of Nations, the International Chamber of Commerce and many other international organizations with wide interests and legal, artistic and business development of wireless.

In view of the coming meeting which is to be largely devoted to working out legal problems connected with radio broadcasting and communications, radio amateurs throughout the world have decided to hold a meeting at the same time and co-operate in the fullest measure possible.

GERMANY

New "Eiffel Tower" for Radio

The construction of an "Eiffel Tower" in Berlin for a radio transmitting station was started recently. The tower is to to be 418 feet high, being less than half the height of the Parisian tower. There will be a restaurant on the first platform, 146 feet above the ground. At 406 feet there will be a platform which will be open to sightseers, and may be reached by an elevator. This tower will be the highest in Berlin built primarily for radio.

Chimney Sweeps Hunt Illicit Radio Sets

German fans object to being taxed even 24 marks a year for the privilege of listening in, and do not take out licenses. So difficult has it become for the postal authorities to locate unlicensed radio sets that considerable sleuthing is now necessary. All letter-carriers and even chimney sweeps have been called in to assist the post office in locating unlicensed radio sets. The enlisting of the chimney sweeps was a strategic move, since these master craftsmen of sometimes 20 year's experience, are the privileged entrants of every home in their districts.

SOUTH AFRICA

Underground Experiments

The Congo Caves, located on the outskirts of Odutshoorn, a town in the Cape Colony, has become world famed. The caves were discovered inside a mountain, bringing to light historical carving and wonderful scenic effects. An experiment was recently conducted inside the caves with a six-tube receiver, and although the party was more than 900 feet inside the caves, Johannesburg, over 700 miles away, was heard on a loud speaker.

AUSTRALIA

Melba Broadcasts

Nellie Melba's last appearance on the operatic stage of Melbourne was her first appearance as a radio vocalist in English territory. Viewed from that angle alone, therefore, the radio transmission of "La Boheme" from His Majesty's Theatre recently had great historical interest. But in addition, it marked the opening of the big Braybrook station's radio service.

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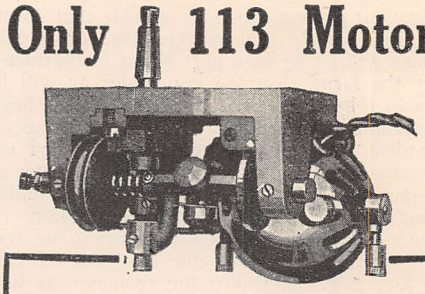

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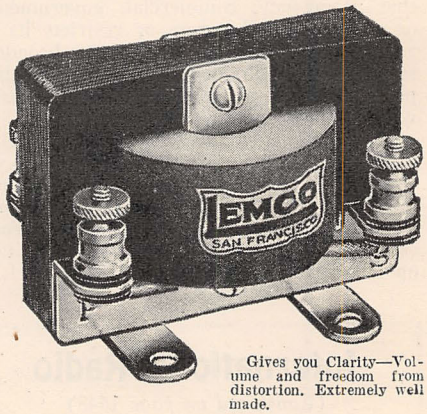

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Trondhjem, started operating about the first of the year. The power of the station is rated at 1.5 kw. It is officially estimated that there are about 10,000 amateurs in Norway and that 7,000 will pay taxes now that broadcasting has started.

ITALY

Install Pope's Radio Set

The special broadcast receiver which was presented to His Holiness by the Marconi Company, consists of a Marconiphone receiver with loud speaker combination, which enables broadcasting from the principal capitals of Europe to be received. It is understood that the set has been installed in one of the best drawing rooms of the Vatican and that it will be used during diplomatic receptions.

RADIO IMPRACTICAL FOR MINE WORK

Evidently there is a limit to what radio can do despite its almost universal adaptation to many utilitarian needs. The sixth report of the engineers investigating the possibilities of communicating in mines for the Department of Interior points out that the present means of pure radio communication is impractical under general mining conditions. In making this report, Bureau of Mines Engineers J. J. Jakosky and D. H. Zellers state in part:

"Because of the high earth conductivity and resultant attenuation of the high frequency radio waves in penetrating the earth, relatively high-power equipment, which means bulk and weight, is required. Such equipment is now believed to be impractical for general mine communication or for mine-rescue purposes. For reliable communication by pure radio over distances of even 1,000 to 2,000 feet through strata would, in all probability, require transmitting equipment with an output of from 50 to 200 watts or more, and used in conjunction with a sensitive receiver. Such equipment would be much too bulky, heavy and complicated to fulfill the requirements for a practical mine apparatus. In transmitting, vacuum tubes are the only present known means of generating the short wave high frequency continuous currents such as could be used for voice transmission. The comparatively heavy and bulky power supply for plate current, filament supply and auxiliary apparatus makes vacuum tube equipment of 50 to 200 watts output considerably heavier, bulkier and too fragile and delicate for practical mine communication purposes."

RADIO STOCKS SOAR

Probably the most remarkable flareup which has occurred since radio stocks became objects of speculation in the market developed on January 2 on the Stock Exchange and in the Curb Market, where 18 of the issues are dealt in actively.

The movement probably received its impetus from the fact that numbers by well-known opera singers were broadcast on the previous night, and the fires of speculation were fed by the knowledge received in Wall Street during the day that some of the corporations had made more money in 1924 than even their most optimistic organizers had anticipated. Whatever the cause, radio stocks have caught the speculative imagination of Wall Street in more fantastic fashion than at any time since the oil industry developed and oil stocks took the center of the speculative stage.

On the Stock Exchange Radio Corporation of America stock advanced 13 points and American Bosch Magneto advanced 15⅞

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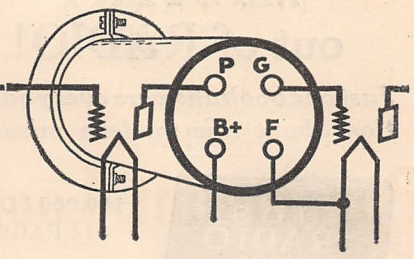

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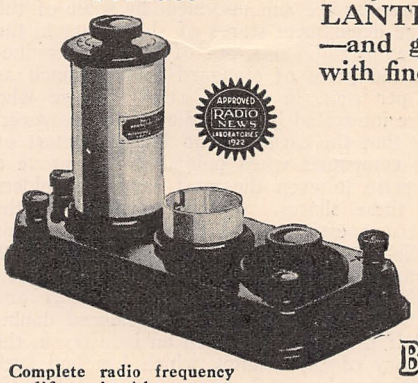

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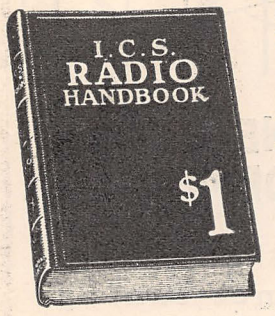

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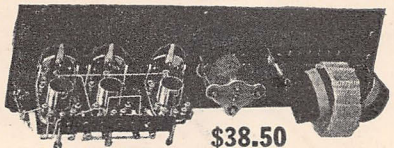

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points during the day in trading, which could be called nothing less than wild. In these shares there were frequently 2 or 3 points between sales and the specialists were inundated with business all day. Incidentally, there was a great deal of criticism last night of the wild gyrations allowed to take place in these two issues, evidently, it was said, under the guidance of pools organized for their benefit. The activities in Radio Corporation of America were not new to Wall Street because the stock always has been violent in its swings. The upturn in American Bosch Magneto, however, was something new. The corporation has just entered the radio field and, of course, its earnings from that source are of necessity meager thus far. It was said that probably in both cases the up-swings were aided by shorts, which were obliged to "pay through the nose" for the stock they were obliged to repurchase.

The record of sales of the radio shares in Wall Street on January 2 follows:

	Sales	High	Low	Last	Net Ch'ge
Am Bosch Mag..	26,300	49⅜	33	48½	+15⅞
C. Freshman, w i	6,500	24	23¼	24	+ ⅞
DeForest v t cfs	20,300	30	27½	30	+ 1½
Dubilier C & R.	3,400	67½	65¾	67	— ⅞
Do new, w i..	900	33⅜	33	33⅜	+ ⅛
Do rts, w i..	1,400	1⅝	1½	1½	— ¼
Duplex C & R v t cfs, w i...	3,500	13¼	12⅜	13¼	+ ⅞
Freed - Eisemann, w i	4,700	32½	32	32½	+ ⅜
Hazeltine	14,300	51	47⅞	50½	+ 2½
Inter-Ocean	700	13	12⅜	13	+ ⅜
Jones	3,100	8⅜	7⅞	8	+ ⅛
Liberty Radio Chain Stores..	3,400	8⅛	7¾	8⅛	+ ⅛
Radio Corp Am.	173,800	77⅞	66¾	77¾	+13
Do pf	350	50	49⅞	49⅞	— ⅛
Do old	2,700	15½	13	15¼	+ 1⅜
Do old pf.....	100	5	5	5	+ ⅛
Rova stk tr cfs..	500	12¼	12	12⅛	— ⅛
Sleeper v t cfs..	3,400	17⅜	17	17	..
Thermiodyne ...	7,800	20	19	20	+ ¾
Thompson (R E) v t cfs.....	14,000	24⅝	21	24⅛	+ 3⅞
Tower Mfg	100	23	23	23	..
Ware	2,400	40	39¼	40	+ ½

An incident of the day which appeared to have no effect on the market for these issues was the announcement by some of the large department stores of sharp cuts in the prices of radio sets, one of the stores reducing the price of standard sets as much as 80 per cent. in a few cases. Those who were interested in the radio stocks, however, say that the earnings for 1924 for most of the companies when published will prove a surprise to even the most sanguine holders of these shares. Careful students of the industry estimate the total dollar sales of radio sets and parts in 1924 at $350,000,000, compared with $120,000,000 in 1923, $60,000,000 in 1922, $5,000,000 in 1921 and $2,000,000 in 1920. It is considered doubtful if there ever has been an industry in the history of the country which has had such phenomenal growth.

Wall Street is anxious to point out, however, that practically all of these stocks are speculations pure and simple; that not one of them is in the investment class, and that in only a few scattered cases are any dividends being paid at the moment. Most of the rises in stock prices have been based on hopes that the industry will continue to expand and that good dividends will eventually accrue to stockholders.

At least a dozen formal offerings of new radio stocks have been made by investment bankers during the last two months. Each of these bankers has pointed out that the stocks were offered as a speculation. In every case they have been oversubscribed. In one particular instance the oversubscription amounted to fourteen times the amount of stock offered.

RADIO SUPERVISORS NEED MORE EQUIPMENT FOR 1925

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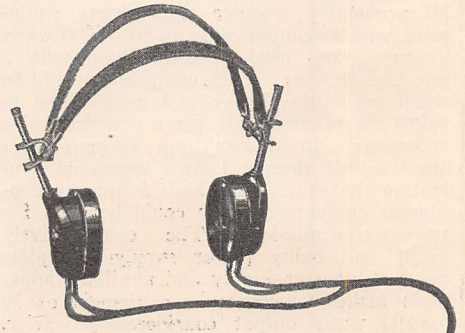

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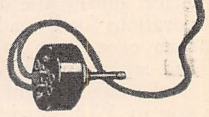

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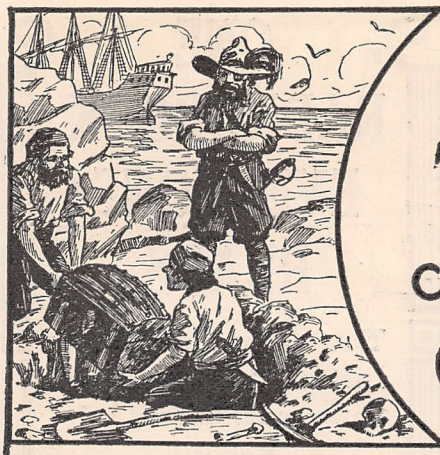

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I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

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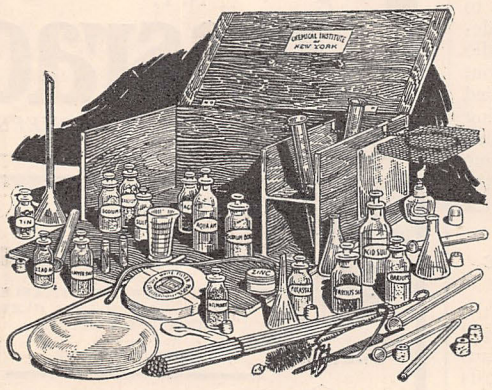

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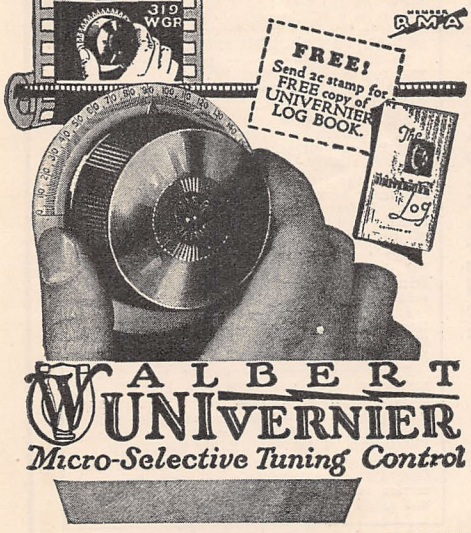

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apparatus and wavemeters is essential, if they are to keep stations on their proper wave-lengths and see that they are not using excessive power.

Most of the inspectors now have wavemeters so that they can measure the transmitted waves of all stations, correcting them when they are off their wave-lengths, but none of the field workers who police the air have equipment for measuring field strength. This apparatus is used to ascertain the intensity of signals of a transmitting station at different distances. It measures the strength of the received signal, from which the power of the transmitter may be approximated. With such a piece of apparatus on a truck or automobile, inspectors would listen in and measure the average strength of the signal of a broadcast station at a distance of one mile, five miles and twenty-five miles. This would enable them to determine whether 500 watts or 1,000 watts are necessary for covering a given territory.

The only dependable equipment of this type known is that developed by the American Tel. & Tel. Co. With using such apparatus mounted on trucks, which would also carry portable receiving sets, with loop antennae, departmental inspectors could greatly increase the efficiency of their work and cover more territory.

It is understood that the Department hopes to secure authority to purchase at least four light trucks with full field radio equipment during the coming year, so as to speed up its work on detecting offenders of aerial traffic laws, keep stations in their allotted radio channels and locate interference. Later on it is hoped a truck for each of the nine radio supervisory districts can be secured.

The need for radio equipped trucks or automobiles by the radio inspectors is indicated in a recent report of some radio field work in San Francisco by Supervisor Dillon.

The location of outside interference, sometimes called "faults," Mr. Dillon points out, has been due almost entirely to the fact that the inspectors were able to mount a receiving set and a loop on an automobile and trace the interference from point to point until maximum signals were heard in the close proximity of the fault.

Inspectors McGowan and Lovejoy worked until midnight seeking the origin of interference reported by about 150 fans in San Francisco recently, and finally ran it to earth as a defective light fixture. The defective light caused interference in radio broadcasting throughout an area of about six square miles, as the noises were carried to various parts of the city on connecting and parallel light and power lines. Some of the fans aided in tracing this troublesome interference by lending their autos so that the inspectors could travel about tracing the noises.

RADIO COMPLAINTS APPROXIMATE 5,000 A MONTH

During November the supervisors of the nine radio districts of the country received 3,944 complaints of interference from fans and amateurs, not including many protests over the phone and in person, of which no record was kept. The cases reported covered many sources and forms of interference: the spark set on board a ship transmitting off its wave-length; the broadcast station emitting harmonics and the amateur who transmitted code during the silent periods. Practically every complaint will have to be investigated by a field representative of the radio section of the Department of Commerce, and in many instances an inspector will have to travel far afield to locate and remedy the trouble. Some of them, however, are probably due to the carelessness of the fans in operating radiating receivers, but all cause more work for the small field force of the Department.

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The supervisor in Atlanta reported only 30 formal complaints, but added that they came from 15 cities in his territory. The Chicago district led with 756 written complaints; San Francisco reported 750; New York estimated 700; Baltimore, 555; Seattle, 500; Detroit, 312; Boston, 306 (broadcasters and the press reporting about 600); New Orleans, 32; and Atlanta, 30. It is believed that, all told, about 5,000 complaints were received, including phone and other protests.

DETECTIVES DETECT DETECTORS IN DEUTSCHLAND

German radio fans object to being taxed, even 24 marks a year, for the privilege of listening in, and do not take out licenses. So difficult has it become for the postal authorities to locate unlicensed radio sets that considerable sleuthing is now necessary, reports from Berlin state. All letter-carriers and even the chimney-sweeping industry have been called to assist the Post Office in locating and spying out unlicensed radio receivers. When it is realized that there are about 250,000 unlicensed sets in operation, and approximately 100,000 in Berlin alone, it is seen that the authorities are losing about 6,000,000 marks a year. Unlicensed reception is reported as still growing and the Government is striving to stamp out the practice.

The enlistment of the co-operation of the chimney sweeps was a strategic move on the part of the municipalities, since these master craftsmen of sometimes 20 years' experience are the privileged entrants of every home in their districts. Chimneys in Germany are the kind designed for Santa Claus; that is, they are large and readily climbed or entered from the tops. Regular cleaning is part of the monthly routine, and the master sweeps are appointees of the municipalities.

When the sooty leather-suited sweeps and their apprentices appear at the door, the Hausfrau is practically forced to admit them, black and dirty as they are, for her chimney must be cleaned. As these men cover the same territory for years, they know every nook and cranny of the individual chimneys as well as of the general domiciles. During their regular work they have excellent opportunities to discover illicitly operated receiving sets.

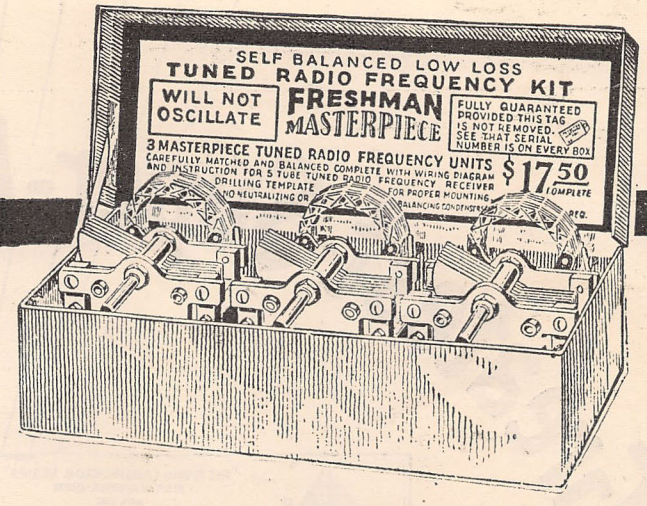
Seldom does the Hausfrau have time to hide radio apparatus or take down the aerial after the sweeps appear at the door. It is believed that through the constant surveylance of the trusty sweeps that unlicensed radio sets will soon disappear. Postmen, too, keep an eye aloft for antennae, reporting also the receipt by post of any packages believed to contain radio sets or parts.

The German government also lectures unlicensed unauthorized fans over the air every night, advising them of the law which confiscates unauthorized use of sets. Officials plan to broadcast seizures together with the names of individuals found to be evading the radio law.

Evidently it takes a detective to detect a radio detector in Germany.

RADIO AND FELONIOUS WEAPONS

Radio does not hold the dignified and useful position abroad that it holds in America, and in some instances radio apparatus is classed with the felonious weapons of cracksmen, burglars and gangsters. Imagine putting a harmless receiving set in the same list with the tools and implements of the underworld. Yet this is just what has happened in British West Africa. By an order of the Gold Coast Colony Council "knuckle dusters," better known as brass knuckles used



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Kit consists of 3 Masterpiece Tuned Radio Frequency Units carefully matched and balanced. Complete with wiring diagram and instructions for building any 5 tube tuned radio frequency receiver and also drilling template for proper mountings **$17.50**

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The new Consrad Patterns contain every possible idea that will be of assistance to the user of these patterns while constructing the receiver. The latest innovation is the printing of the wiring diagram on the new patterns in four colors; thus, GREEN for the Tuner-Oscillator circuit, YELLOW for the low potential wiring or "A" battery circuit, RED for the plate and "B" battery circuit and WHITE for the grid circuit.

This unique idea makes the wiring of the set much easier and prevents any possibility of making a mistake by misreading the blueprint.

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Consrad is again right up to the minute by publishing in its usual complete form a pattern on the authentic Tropadyne circuit. This pattern contains two extra large sized blueprints (19 by 22 inches). The blueprint of the wiring diagram is printed in the latest Consrad method explained elsewhere on this page. With these blueprints comes a large 16 page booklet complete in every detail, fully illustrated and written in plain understandable English.

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Consrad

RADIO'S FOREMOST PUBLISHERS—Everything in Books, Patterns and Diagrams

by thugs and toughs as weapons, wireless sets are classified in the same catagory and placed on the list of prohibited imports, according to an official report to the U. S. Department of Commerce.

RADIO AND THE PUBLIC

By HERBERT HOOVER

The greatest development in broadcasting during the past year has not been in the application of new methods of transmission or reception, important as improvements in these lines have been. It is rather in the change in public attitude. Listeners are becoming more and more appreciative of the real service of radio and increasingly critical both as to the character of the matter furnished them and as to the efficiency with which it reaches them. The whole broadcasting structure is built upon service to the listeners. They are beginning to realize their importance, to assert their interest and to voice their wishes. Broadcasting must be conducted to meet their demands and this necessarily means higher character in what is transmitted and better quality in its reproduction to the ears of the listener. The broadcasters, as a whole, are alive to the situation. There is a growing realization on their part of the public responsibilities they assume in conducting an agency so greatly affecting the cultural progress of our people. The innovations of which we hear so much—national progress, wire interconnection, short wave re-broadcasting, increased power and wired radio, which are already playing so important a part and are destined to have still greater influence for good—are based entirely upon the necessity for meeting the growing popular requirement of better service. The demand will continue to increase, and new methods of efficiency will continue to be found to meet it. But, beyond all, radio has begun to enrich American life by a real contribution to the home. It yet has far greater service to perform in this way and I believe the next year will see a greater and more definite advance in this direction.

USE OF EXCESSIVE POWER PROHIBITED

A number of complaints have been received by the Bureau of Navigation regarding the use of excessive power by coast and ship stations, causing interference to other stations. Operators are cautioned to use the minimum amount of power, as the use of excessive power is a violation of regulation 14 of the act of August 13, 1912, which is as follows: "In all circumstances, except in case of signals or radiograms relating to vessels in distress, all stations shall use the minimum amount of energy necessary to carry out any communication desired."

It is also a violation of article 7, paragraph 1, of the International Convention service regulations, which is as follows: "All stations are bound to carry on the service with the minimum of energy necessary to insure safe communication."

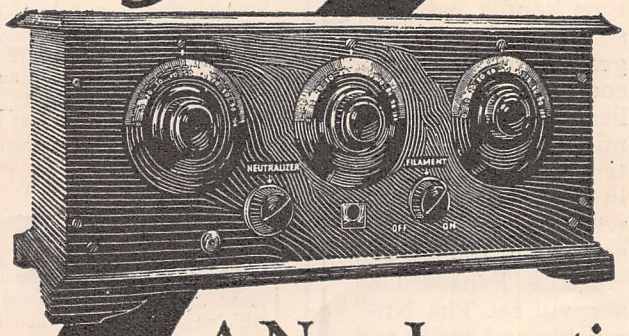
RADIO DEVELOPMENT DURING 1924

By JUDGE S. B. DAVIS

In radio development during the past year two factors are outstanding—the use of the short waves and wire interconnection of stations. Both are of great importance. The short wave has found its place in commercial and amateur trans-oceanic communication and in transmission of re-broadcasting, both at home and to places across the seas. In domestic use it is a rival of wire interconnection, both being a means to the same end,

Making friends from Coast to Coast with the

RICHARDSON 5



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the furnishing of simultaneous programs to several stations. I consider interconnection, in whichever mode effected, almost essential to the future of broadcasting, if we are to look at radio as a means of service to all our people all the time. It ultimately means national programs, nation-wide utterances, more valuable subject matter and that great happenings in which our people have so vital an interest will be made available to everybody. To give them an immediate touch with national and world happenings must result in better citizenship. We have already seen examples of nation-wide communication in the simultaneous broadcasting on several occasions by stations from the Atlantic to the Pacific, and it is now a nightly practice within extensive areas. All this has happened in the past year. It is transforming broadcasting from a local to a national service, and this not by way of detriment to the local stations, which are the backbone of the system, but as an advantage to them. Interconnection, with its corrallary of national service, is only just beginning. It will go much farther. Its development, together with some general rise in the power level of stations for the overcoming of static and interference, giving us really useful reception, will, I believe, be the principal improvements in the immediate future.

I look for remarkable development along these lines for the good of broadcasting, which means for the benefit of the listener, during the coming year.

A SCIENTIFIC EXPERIMENT

(Embodying a practical application of the statement, made recently, by Sir Oliver Lodge, that mankind was unconsciously using the ether to transmit messages long before the arrival of wireless—"not when we spoke to each other, for then we only used the air, but when we smiled, winked, or nodded.")

A man, a maid, a park, a seat,
And, last, a summer's day—
The apparatus seems complete;
And now for its display.
A glance, a look; a lowered book;
A shrug, the lightest sigh—
The spoken word seems slow, absurd
When these are wafted by.

But will the present set transmit
A plainer code than this?
It may; one can but chance a hit
Or, at the worst, a miss.
He risks a frown; a cough, and down
The ambient ether flies
The more direct than circumspect
Inquiry in his eyes.

That message takes its urgent flight
And all its tale is told;
The one transmission seems all right—
But will the other hold?
Does science shirk? Or will it work?
It works, it works, I think!
For back through space there flies apace
Her most ethereal wink.

LUCIO

Reprinted, with acknowledgements, from the Manchester Guardian.

IS MENTAL RADIO A POSSIBILITY?

By CARL H. BUTMAN

The radio science is developing so rapidly we may all be wrong in the belief that apparatus is necessary for transmitting and receiving communications by radio. First, we eliminated connecting wires; now we get on without antenna and batteries, while some experimenters even claim no tubes are necessary. There are also those who believe no receiving sets or phones are required if the mind is properly tuned and controlled.

While the writer has made no experiments in this field and can make no claims for the suggested development, he hesitates to dis-

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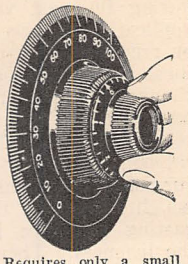

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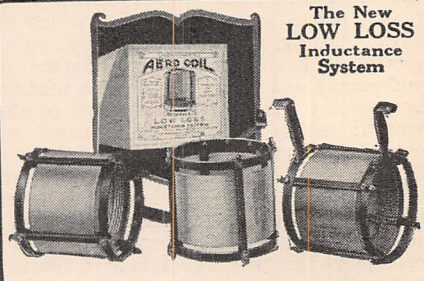

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95% air dielectric. Dopeless windings properly air spaced. No other inductance system has such ideal electrical characteristics. Get a set today. $3.50 each or $10.50 the complete set with all fittings. At your dealer's or direct. Write for Bulletin H4, "The Prevention of R. F. Losses," which also includes Hookup and instructions for building the wonderful new Henninger Aero-Dyne.

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claim future possibilities, offering the story for what it is worth. There is such a thing as mental telepathy—what follows may be the next step:

What is termed "mental radio" or "vocal wireless" is causing consternation in the minds of many citizens who have written to governmental officials at Washington appraising them of alleged unlicensed radio operation which, in some instances, approaches persecution. The first complaint was from a sea-going radio operator made to the Department of Commerce a few years ago.

Communications received recently by the Signal Corps from several cities intimate a military value in the secret methods of wireless communication which seem to require no receiving set or antenna. At the same time, it is claimed they are used illegally, by those posted in the new science, for criminal mental control. It is stated by some women that this means of ether communication is being employed to "drive them crazy."

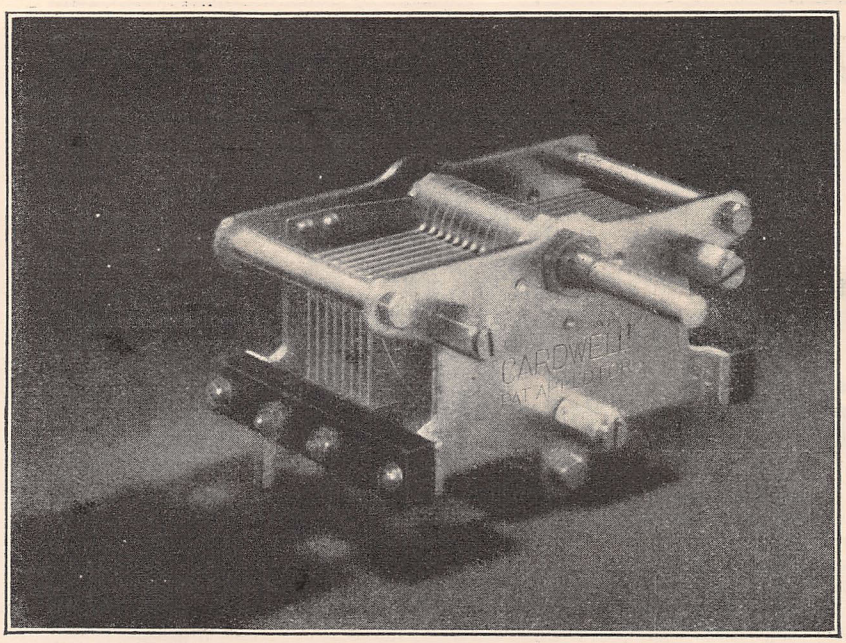
Government experts in medicine and radio have as yet found no explanation for the mysterious system reported from several quarters here, and understood also to be in operation in England.

According to a man in Alabama, who has recorded what he knows of the new science, "mental radio" was used at one time in head-to-head communication, by concentrating when sending to another person, and by turning aside one's mind, as it were, in receiving. Later, he reports to the Signal Corps, it became easier when persons were properly magnetized. The present method seems to indicate the use of electrical hypnosis by green rays, from which an individual can become invested with mental radio and speak and hear at a distance. Different registers, such as upper-head register, are used when sending to persons at a distance, with varying pitches, but the messages may also be relayed from another person. Voice radio as well as mental radio may be transmitted, he avers.

Reception is had through the ears, although it is believed that vibratory methods aid. Pulling the ears upward or downward often increases the strength of the incoming message, says the recorder, who admits he does not know just how the reception is effected. He suggests "hypnotic" or "concentrative control," giving the ears a "radio receptivity."

The danger of radio (mental) lies in the fact that by vibratory messages sent through the air to vital organs, sickness not yet recognized by the medical profession may be caused, the author explains. The whole idea seems to be a development of mental telepathy to the nth degree. It is believed by the investigator that prints, maps and drawings may be imposed upon the mind of a person receiving such messages, which he can reproduce on paper. A further development, known as "psychic eyes," it is held, might be employed in espionage work and for the purpose of blackmail. A desire is expressed that the Government should investigate all phases of this almost unknown art, else public welfare may suffer. The publication of what is known of the method was urged on the Signal Corps, so that private citizens can protect themselves.

He is not alone in his beliefs. Writing from New York, a woman, who suffers from "vocal wireless," says she experiences there the same reception she sought to avoid in England some months before. She claims that aliens operate a station in England, using a combination of phonograph and wireless apparatus, from which they transmit messages to her; sometimes a chorus of voices comes in, at other times the voices of her friends and, as some of them are deceased, she believes old phonographic records are used. Vibratory effects also sent by this



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CARDWELL invented the original *low-loss* condenser, using metal end plates and a grounded rotor. The phrase "low-loss" was in fact first applied to Cardwell Condensers by engineers to distinguish these highly efficient condensers from the ordinary varieties.

Cardwell Condensers have been universally adopted by radio editors, experts, and professionals. Cardwells have become the standard of comparison.

Performance is the only real test of a condenser. And Cardwell Condensers have proved their superiority because of their scientifically correct design—small area of contact between insulation and stator supports, rigid three-point frame, permanent alignment, accurate adjustment, etc.

Such details permit exceptional distance records, smooth tuning free from noise, and prevent changes in capacity at given settings.

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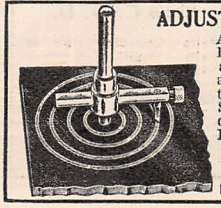

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The Boy's Electric Toys contains: Enough material to make and complete over twenty-five different electrical apparatus without any other tools except a screw-driver furnished with the outfit. Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp, etc. Enough various parts, wire, etc., are furnished to make the following apparatus:

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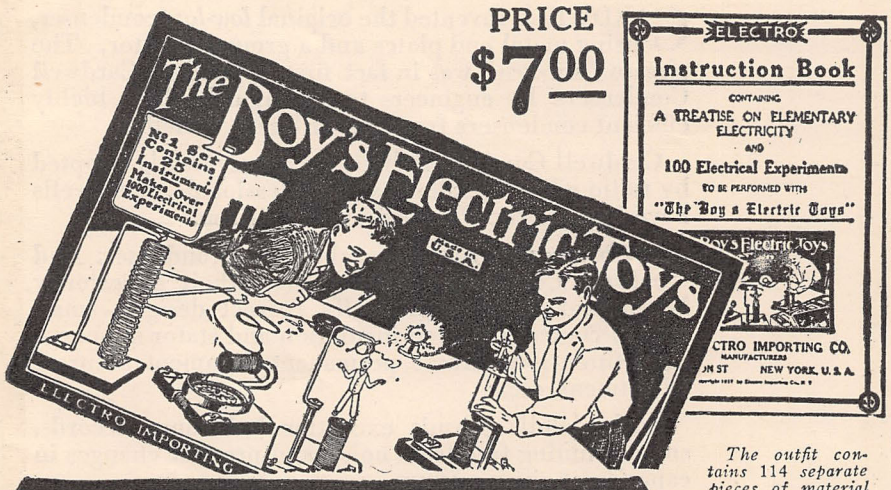
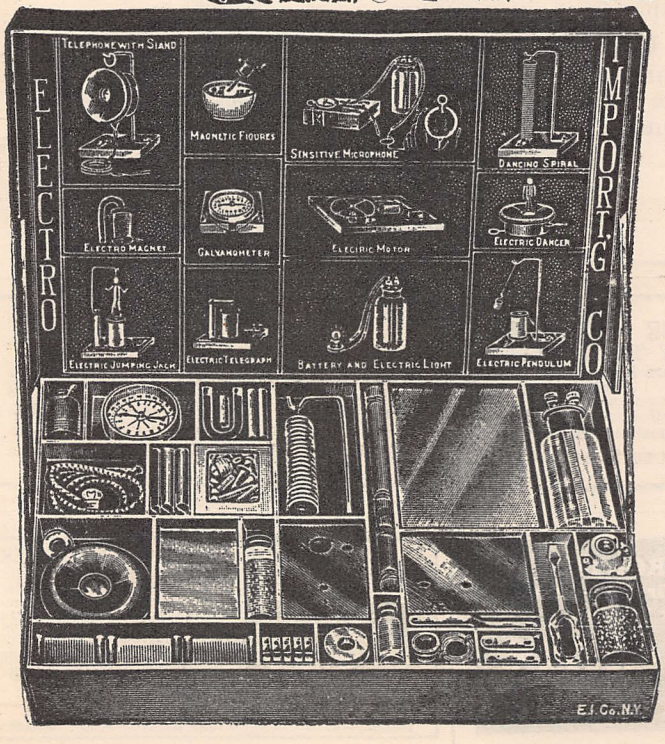
With the instruction book we furnish one hundred experiments that can be made with this outfit, nearly all of these being illustrated with superb illustrations. No other materials, goods or supplies are necessary.

PRICE $7.00





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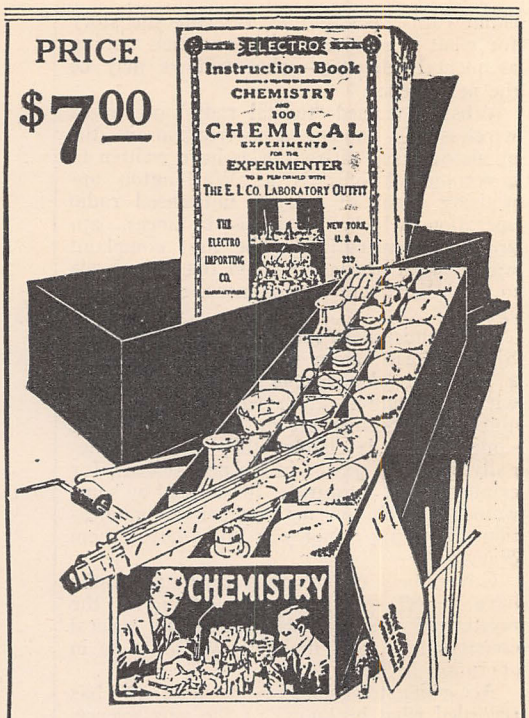

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A good part of the book is devoted to Weights and Measures. The Metric System, The English System and the U. S. System are fully explained.

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method are complained of. They come in night and day and are most undesirable. Sometimes visions and reflections have also been received, she states. This matter was pointed out to the British War Office in 1919 and Senator Marconi was also informed, but no effort to intercept the messages was made.

The use of the X-ray is also believed by this correspondent to be employed by her persecutors, who manipulate the main apparatus and perpetual current by small portable sets carried concealed under their clothes. Emitted electric waves, she asserts, enter the individual controlled at the spinal chord and ascend to the brain, where they assume complete control, and operate silently. Having gained complete physical and mental control of an individual, the operators then transmit messages or pictures at will. One plant in England, she states, has a range of 600 miles, while others operate for distances of 1,000 miles, with extensions to Australia. The fluid used in the visual work is believed by her to be a radiant chloride, composed of carbon, radium and liquid silver.

Another woman reports that for four years she has received what she calls "metered phone" messages from an operator who signs himself "Seth." He explains that she is acted upon by a wireless telephony and a gas called "pipeford." Voices accompany the carrier waves. She believes that they are transmitted by men desirous of beating people into insanity for money.

A woman resident in Brooklyn seeks protection from a "vile" station which annoys her constantly day and night, frequently causing prostration by scientific devices. Among other causes, she suspects spiritualists and believes experts could fathom her difficulty. Code and "aerograms" are sent to women whom the operators desire to make insane, according to her appeals.

RADIO EXPORTS FOR 1924 ESTIMATED AT OVER $6,000,000

Exports of radio apparatus from the United States have increased almost $200,000 a month recently, and if the December exports increase in proportion, the total exports for the year will reach a value of over $6,000,000. Last year the exports totaled $3,448,112. So far, for 11 months, the total is $4,950,746, a million and a half more.

Department of Commerce experts believe that this year's exports will be practically twice those of the year 1923. At the end of the seven-month period in 1924, radio exports were valued at $2,123,832, against $1,894,823 during the same period the previous year. During the past four months, however, these exports totaled $2,826,914, increasing as follows: August, $541,238; September, $567,434; October, $769,249, and November, a record month, $948,993.

In weight the November exports amounted to 593,686 pounds, compared with 507,193 pounds for October and 338,919 pounds for September.

All electrical exports from the United States in 1924 will exceed those of 1923 in value by about $12,000,000, the Department of Commerce states. With the increasing demand for radio apparatus abroad, due chiefly to the dissemination of radio knowledge, the increasing tendency in other countries to remove restrictions on imports, and the greater freedom granted to broadcasters overseas, radio apparatus experts of the United States have increased materially. The exportation of storage batteries, both primary and secondary, also shows a decided increase in the past year, compared with the 1923 figures, but batteries are not included in the totals given above, as radio batteries are not segregated as such.

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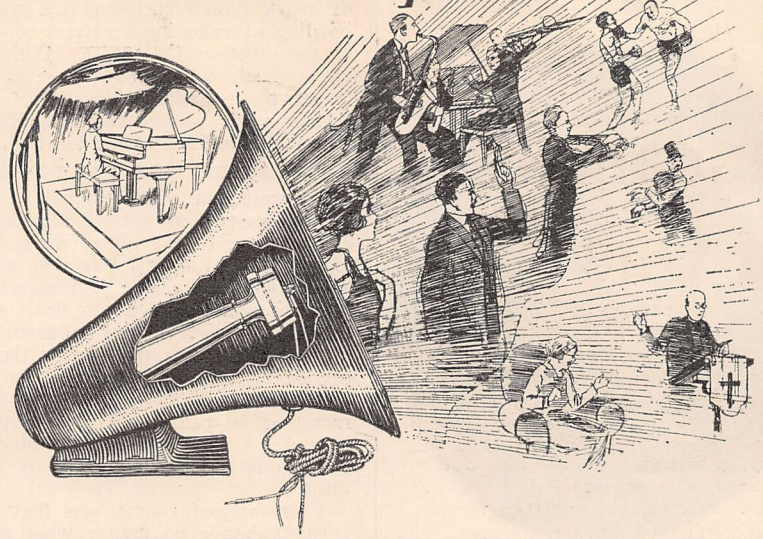
Radio Reproducer



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No piece of radio apparatus is really sold unless it stays sold, unless the purchaser every day is more satisfied with his purchase than he was the day before.

"Must admit such courtesy is very seldom accorded a purchaser by other companies. It is a real pleasure to deal with a firm which meets one more than halfway. I believe that your product will be a decided advantage to my line of cabinet sets."

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Baby Grand Reproducer, with gold plated unit, black and gold crackle or extra heavy coated all black satin finish (approx. 12" bell)	$12.00
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Electro-magnetic unit (fits almost any horn or phonograph) with cord, nickel plated	4.00
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No extra batteries required.

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TRANSPORTATION. Single shipments, strictly F. O. B. factory. Free on two or more orders for each item.
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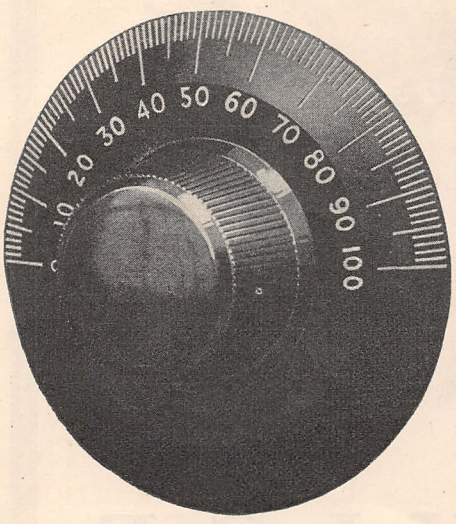
EXPERIMENTER PUBLISHING CO., 53 Park Place, New York City

Visco Vernier Dial



A vernier dial operating on a new principle. No gears, hence NO BACK LASH.

Both the quick and the precise adjustment without changing the grip or changing gears (there being no gears). A moderate pressure will turn the dial quickly *to any desired position* and with a light pressure it will creep without jerk or jar precisely to a hair line adjustment. Always ready.

Helps to steady condensers with loose bearings.

Efficient, Practical and Cheap

To install, it is only necessary to take off the old dial and put on the new.

Genuine Bakelite, 3¼ inches in diameter, fits ¼ inch shaft.

If after 10 days' trial you are not satisfied, return the dial and we will return the purchase price.

Patented

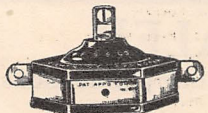
Price $1.00 Postpaid

The Monosmith Brothers Company

Spencer, Ohio

KEYSTONE RADIO LIGHTNING ARRESTERS

Perhaps you're not getting the best reception because you aren't using a Low Loss Keystone Arrester. The Low Loss Keystone, made from genuine Bakelite with solid brass parts, provides perfect insulation between aerial and ground. To comply with fire laws you must use a Lightning Arrester. It will pay you to install a Low Loss Keystone Arrester. Approved by Fire Underwriters. E1835. Get one today.



$1.50 Complete **$2.00** In Canada

ELECTRIC SERVICE SUPPLIES CO. Philadelphia New York Chicago

INTERFERENCE AN UNNECESSARY EVIL

Tuning around spark sets and howls from regenerative sets has become the favorite but involuntary indoor sport of radio audiences of late. It would be hard, after listening night after night to the whine or drone of spark interference and the warbling or howling of radiating receivers to define one or the other as the worse. Both nuisances are so easily curable that it seems according to viewpoints expressed by persons with the best interests of radio at heart, rather absurd that they should continue to exist.

SUPERVISOR HAS POWER

Governmental steps toward clearing the atmosphere of constant offenders is regarded as the matter of but a brief while. Contrary to the general belief, this will not require any action on the part of Congress. Radio regulations already cover this, and every radiating receiver that is a known source of interference comes now under the jurisdiction of the radio supervisor. It is within his power to order the offending set made non-radiating on penalty of its use being prohibited. A radiating set is a transmitter and as such is under the control of the supervisor.

There are, of course, sets that radiate to a small degree no matter what precautions are taken by the user; but the interference from these is hardly apparent to the most sensitive receivers within a radius of half a block.

IGNORANCE A FACTOR

Despite educational efforts, ignorance and indifference continue to play large parts in radiation nuisances. Not that anyone who has read up even in a small way doesn't understand the evil and, vaguely the cause; but that they fail or refuse to recognize the fact that they themselves often are the means of ruining their neighbors' enjoyment—and their own.

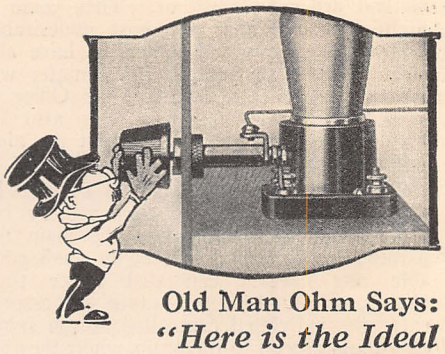
A set that is radiating never can be delivering anything approaching sweet musical notes or clear speech. At best, there is a mushiness which thickens speech and garbles tones. If in no other way a receiver owner can tell when his tube is in oscillation he surely can in this way: By turning down the filament and adjusting the plate circuit control he will clear up his reception. The point where it is clearest is the proper operating point for the tube. Bringing in outside stations will be a bit more difficult, perhaps, but there will be greater satisfaction all around. Where signals must be found by a beat note, the tube filament should be lowered to the proper operating point the moment the station's carrier has been located, and tuned in without the beat note. If the beat note can be picked up, then the station can also be without radiation.

Try that out, if you have been in the habit of tuning in beat notes.

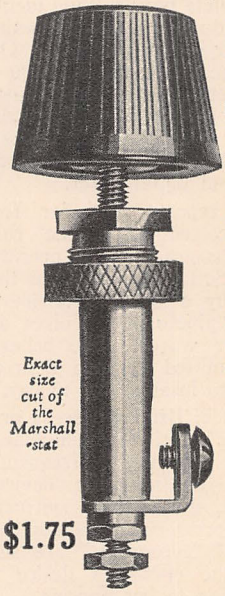
EASTERN KENTUCKY COMMUNITY DESIRES RADIO CHURCH SERVICES

Our village is situated in the mountains of Eastern Kentucky, in Martin County, away from railroads or good roads that would give us access to outside communication. We are a farming class of people, but have very poor farming facilities as most of our lands are hills and rough at that. We have no marketable products to speak of as most everyone barely raises enough farm products for home consumption. Our village is practicaly without church services. Once in a while a minister visits our locality and delivers us a sermon, but this does not occur more than once or twice a year.

In our neighborhood, covering a radius of not more than three miles, live about 300 people. They are interested in Sacred Wor-



Old Man Ohm Says:
"Here is the Ideal Rheostat for all Tubes"



Exact size cut of the Marshall-stat

—and he ought to know. He is the fellow who measures resistance. He finds that the Marshall-stat varies resistance not step by step, but smoothly, continuously and uninterruptedly from zero to maximum.

He also finds—and you will too—that the Marshall-stat:

Is compact (see exact size cut at left).

Requires only one hole in panel.

Is vernier all the way but requires only one adjustment.

Can be used with any tube or combination of tubes.

Has only two terminals and cannot be connected incorrectly.

MARSHALL ELECTRIC COMPANY
3235 Locust Bl.
St. Louis, Mo.

$1.75

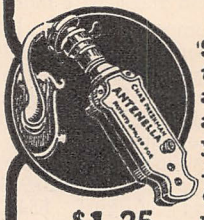
Marshall-stat

Old Man Ohm has an interesting folder on the Marshall-stat. Send for it.

The Complete Efficient and Economical Aerial

ANTENELLA

No Aerial or Antenna Needed



$1.25

Why pay $10.00 or more to have an aerial spoil the appearance of your home? Antenella eliminates all unsightly wiring, lightning arresters, etc., and precludes the possibility of dangerous grounding on a power line. It also stops "canary bird" reradiation from nearby oscillating sets interfering.

ANTENELLA
is not only a real distance getter but also successfully overcomes static annoyances.

At your dealer, otherwise send purchase price and you will be supplied postpaid.

Chas. Freshman Co. Inc.
Radio Condenser Products
106 Seventh Ave. New York

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

ship and, when an opportunity is afforded, they flock in to take part and hear the Word, but this is not often for, as I have said, ministers do not come this way often and we are not able to employ a regular minister.

I, being a community worker, have taken the matter up with them of installing a radio receiving set, that we may meet often and hear the Word of God as it is delivered by some able minister in some other part of the country; and they are very enthusiastic about it. We have raised $203.70 of a necessary sum of $250 for the purpose of purchasing a radio receiving set, but being poor people, we are obliged to call upon those better financially situated to come to our rescue. We desire to interest everyone who reads this in our situation and to solicit their aid in our behalf. We desire the co-operation in this matter of every individual, church, society, corporation or any other organization that can lend us financial aid or some of their time in interesting others to help us financially. Arrangements have already been made for the purchase and installation of the radio receiving set and lack only the necessary funds with which to make it effective. I assure you that it is the intention to use whatever is contributed for the purpose outlined above only. If not sufficient donations are received to carry out the above plans, all sums will be returned, as will all over contributions.

For reference, I beg to refer to the following: McHenry Rhoads, State Superintendent, Frankfort, Ky.; J. M. Johnson, County Superintendent of Schools, Inez, Ky., and Inez Deposit Bank, Inez, Ky.

Thanking each reader of this item in advance for their contribution, which should be sent to the address given below, I beg to remain,

DAVELLA COMMUNITY ORGANIZATION,
PARNELL CRUM,
Secretary and Treasurer,
Davella, Martin County, Ky.

THE FOURTH EDUCATIONAL "R"

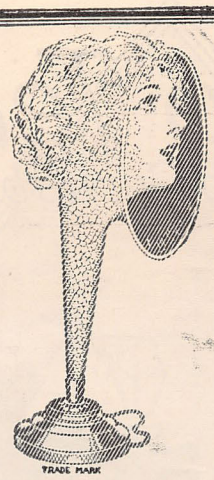
The simple curriculum of old-time schooling composed of the "Three Rs" does not suffice today. "Readin', ritin' and 'rithmetic" no longer cover the basic educational requirements of the modern youth, a fourth "R," standing for radio, has been added. High schools, colleges and even broadcast stations include courses in radio as a major subject.

Through radio broadcasting a new means of disseminating education in many forms is now used practically, and if a tabulation of students actually attending classes at institutions of learning were to be made recently, and compared with a census of the students gaining knowledge from the air, so to speak, it is believed those staying at home and listening in nightly to some 80 stations putting out radio education, would outnumber the former old-style students.

STANDARD AND RELIABLE RADIO ADS

In an effort to secure standards for Truth in Radio Advertisements, the Better Business Bureau of Washington has announced some principles of advertising which have been adopted by the local radio merchants' association. Their plan is considered a constructive means by which public confidence may be secured.

The appropriation and use of type numbers or letters for identifying vacuum tubes, manufactured by others than the original companies, is taboo. For example, "UV-199" is held to apply only to tubes made by the Radio Corporation of America, and should not be employed by other manufacturers.



Atlas

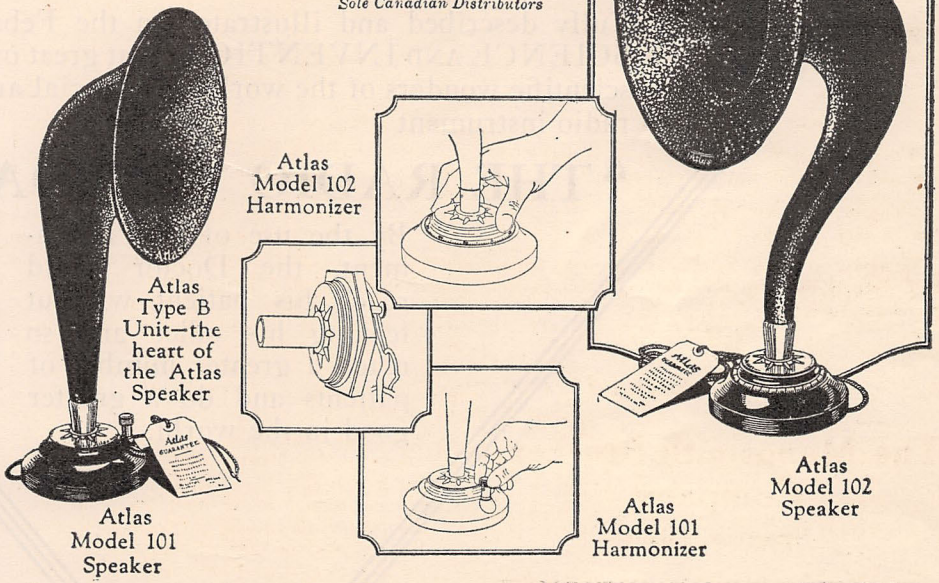
TRADE MARK

RADIO REPRODUCTION
speaker

YOU DO NOT want just noise from your radio set.

Tone-range, quality, clarity, volume; each, alone, just noise. But their balanced combination as from *Atlas* Speakers "gives the best that's in your set". This is balanced Atlas Radio Reproduction.

MULTIPLE ELECTRIC PRODUCTS CO., Inc.
365 Odgen Street, Newark, N. J.
(Dept. W.)
New York, Boston, Philadelphia, Baltimore, Pittsburgh, Detroit, Chicago, St. Louis, San Francisco
Marconi Wireless Telegraph Co. of Canada, Ltd. Sole Canadian Distributors



Atlas Model 102 Harmonizer

Atlas Type B Unit—the heart of the Atlas Speaker

Atlas Model 101 Speaker

Atlas Model 101 Harmonizer

Atlas Model 102 Speaker

FAHNESTOCK CLIPS
The Perfect Radio Connectors—Are Used

By manufacturers of standard sets and parts and makers of wet Battery and exclusive on Eveready Dry Batteries. Their Sure Patented Grip is recognized universally by enthusiastic users.

FAHNESTOCK ELECTRIC COMPANY
Long Island City

DEALERS' SERVICE

We are distributors for such representative lines as:

Freshman Masterpiece and Parts
Triangle Low Loss Condensers
Ultra Handy "A" and "B" Chargers
Adroit Electric Soldering Irons
Bowman Low Loss Condensers
Benjamin Sockets
Bell Sockets and Dials
Hoosick Falls Products
Thordarson Transformer Co.
Teletone Products
Charmitone Loud Speaker

And Other Standard Best Selling Parts

FRIEDLANDER-KOPPLE RADIO SERVICE
149 Church St., New York.
Telephones: Barclay 9337-4919

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year
Experimenter Publishing Co., 53 Park Place, N. Y. C.

The Radio Teledactyl

by Hugo Gernsback.

The Specialist Brought to Your Home by Radio

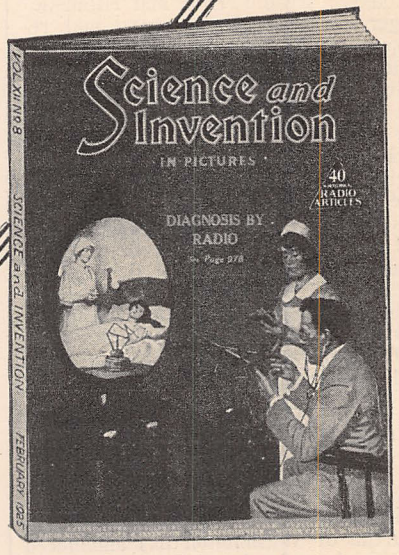
Radio has generously broadened every branch of science. The Doctor, the Surgeon, and the Experimenter have all profited greatly by this tremendous new Science.

The day is not far off when the Specialist will "feel the pulse" of his patient from a great distance and minister to his needs by radio.

Fully described and illustrated in the February issue of SCIENCE AND INVENTION, that great magazine of the scientific wonders of the world, is a special article on a new radio instrument

"THE RADIO TELEDACTYL"

By the use of this instrument, the Doctor could reach his patient without leaving his office and so reach a greater number of patients and do a greater good in the world.



SCIENCE AND INVENTION covers every new and interesting event in the world of Science. Page after page is devoted to pictures with explanations of the most marvelous events that are taking place daily in the world's laboratories.

Science and Invention
IN PICTURES

MARCH ISSUE NOW ON SALE
25c the COPY
ON ALL NEWSSTANDS

Published by
THE EXPERIMENTER PUBLISHING COMPANY
53 Park Place, New York City

Sets built by retailers in their stores should be so marked and not sold as factory products; this applies to Neutrodyne sets particularly, it is pointed out.

When merchandise is advertised as reduced from a certain price list, but represented as possessing the list price value, it should also carry the original guarantees. Claims for reception should be based upon average reception and not freak achievements, the new policy declares.

Advertisements should state whether a set is complete or not, or what accessories, if any, are included at the quoted price. Other regulations include standard battery claims, require that obsolete apparatus should not be represented as still standard, and that when a set is advertised as a leader, the dealers should have a sufficient supply on hand to fill reasonable public demands.

These principles, it is held, will tend to give the radio purchaser faith in both advertisements and dealers.

SIGNING OFF FOR "SOS" CALLS

When an "SOS" call is heard by any commercial, amateur or private broadcast station, the law provides that all stations give it priority and cease sending. While many broadcast stations are quite consistent in complying with this regulation, Department of Commerce officials state that all do not comply. Frequently interference is noted when a ship at sea is calling for aid and other ships and shore stations are trying to communicate with her, relaying messages and locating ships in the neighborhood of the disabled vessel.

Of course, the distress call goes out on 600 meters, which should not interfere with any but the broadcasters using wave-lengths well above 400 meters, but all must cease transmitting until the Navy announces that all is well. It is possible that the department may permit broadcasters on the lower wave-lengths to continue broadcasting during such silent periods, if they do not interfere with the 600-meter wave, but as yet it has not been done.

When broadcast announcers are forced to sign off due to distress calls, it is permissible, departmental radio officials point out, for them to announce the cause briefly so fans will know why the broadcasts cease. The simple announcement: "Ship in distress. Signing off temporarily. Station WRC" is cited as a model.

Some stations do this, but others stop so abruptly that fans are at a loss to know what is the matter; this is what happens when the operator on watch hears the distress call and pulls the main switch. It is believed that if he told the anouncer to sign off as suggested above, it would be a benefit to listeners, who often struggle for a half hour or so to get the station back, wondering what is wrong with their sets, and when radiating sets are used they fill the air with unnecessary squawks and whistles.

NO RADIO FOR HIM

Below is a copy of a letter recently received by the Sigler Electric Company, Mobile, Ala., from a "prospect" who, it is apparent, has no use for radio:

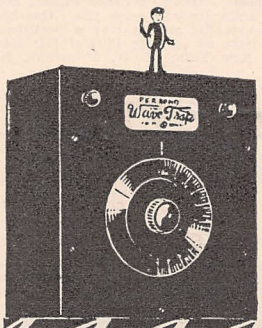
mobile alaBama Desember the 3 1924
Dier sirs i has receved sevral Leters from you you stat in mine—that you Wanted sell me an Radio i thank you for your offer But i has noe time to youse it at all my ocpasion is Rail Road Work and i does not see the need of one agin i deosent iny music at all i am no sport i am a working man and not man for foolishment i Doesnt not need all kind of blues in my home that is the reson the times is like it is to day thar is too mush fas times this is all from yours P Wilson.

LITERALLY thousands of people have come to know the joys of perfect radio reception through the Ferbend Wave Trap. Testimonials from all parts of the world continue to pour in, unsolicited, from those who have equipped their set with this marvelous instrument.

You, too, will find it the shortest, easiest, and—best of all—the least expensive route to clear, undistorted reception—*without interference.* Never reduces, but nearly always increases volume. You can make your set selective to the point of perfection by simply adding a Ferbend Wave Trap. *It will absolutely cut out any local or nearby interfering station, no matter how loud, or how troublesome.* So why pay $50.00 to $200.00 extra for increased selectivity when you can buy it for $8.50?

Guaranteed to tune out any local or nearby interfering station. The Ferbend Wave Trap is designed and manufactured complete by us after years of careful experimenting. It is not to be confused with imitations, hastily assembled from ordinary parts. The price is $8.50. Shipment is made Parcel Post C.O.D., plus a few cents postage. If you prefer, you can send cash in full with order, and we will ship postage prepaid. Clip and mail the COUPON today!

FERBEND ELECTRIC CO.
25 E. South Water Street CHICAGO, ILL.



FERBEND Wave Trap REG. U.S. PAT. OFF.

Always look for this Trade Mark. It is your protection against misleading imitations and those who infringe on the registered name "Wave Trap" and its reputation. "If it isn't a FERBEND, it isn't a WAVE TRAP."

Read the evidence

Dunbar, West Va.
Ferbend Electric Co.
Gentlemen: I bought your Wave Trap to see if I could not cut out the awful noise of telegraph stations which ruined most of our programs. Since we installed it in our five-tube Fada Neutrodyne set we have not heard any more telegraphers—*we let 'em in sometimes to show our friends how easy it is to kick 'em out with the Wave Trap.* I would not have a set without a Ferbend Wave Trap.
(*Signed*) H. E Atherton.

Farragut, Iowa.
Ferbend Electric Co.
Dear Sirs: I set my radio where Havana, Cuba, should come in but received only a jumble of K. F. N. F., W. O. R. and W. L. A. G. I then tuned in with the Trap and had Havana for two hours. I have several times taken a jumble like this and separated five and six stations. I find it a great help in cleaning up stations that can not be brought in distinct. I am using a Crosley X-J.
(*Signed*) W. T. Cox.

Townsend, Md.
Ferbend Electric Co.
Gentlemen: Well to say I am pleased with the Trap is putting it mildly. It is simply a wonderful instrument. I have have had more or less trouble in getting K. D. K. A., W. B. Z., W. D. R. and W. L. W. with my Freed-Eisemann Set as they are only a few degrees apart on my dials. Your Trap lets me through with the clearest possible reception. In my candid opinion there is no Radio Receiving Set complete without the addition of the Ferbend Wave Trap.
(*Signed*) E. W. Stevenson.

FERBEND ELECTRIC CO.
25 E. South Water St., Chicago, Ill.
Gentlemen: Please send me:
☐ WAVE TRAP. Send postpaid. I am enclosing (check, M. O., etc.) for $8.50.
☐ WAVE TRAP. Send C. O. D. I will pay Postman $8.50, plus few cents postage, when it arrives.
☐ FREE BOOKLET on Interference.
Name.....
Address.....
City..... State.....

BLUEBIRD *Radio Tubes*

Distinctly New and Efficient

Satisfying every radio fan's wish in performance and price. Our direct sales plan enables us to sell at this low figure. "Bluebird" is a sensitive and powerful tube, assuring increased range and clear volume.

Type—400 .....5 Volts, 1 Ampere Detector Tube
Type—401A .....5 Volts, .25 Ampere Amplifier and Detector
Type—499 .....3-4 Volts, .06 Ampere Amplifier and Detector
Type 499A .....3-4 Volts, .06 Ampere with Standard Base Amplifier and Detector
Type—412 .....1½ Volts, .25 Ampere Platinum Filament Amplifier and Detector

ALL ABOVE TYPES $2.50

Type—402 .....5 Watt, Transmitters, $3.00

Shipped Parcel Post C.O.D. When Ordering Mention Type.

Designed to give best results in all circuits—Radio Frequency, Neutrodyne, Reflex and Super-Heterodyne Sets, etc.

Every Tube Guaranteed

BLUEBIRD TUBE CO., Dept. N, 200 BROADWAY New York City

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

OPPORTUNITY AD-LETS

Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate twenty-two cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the May issue must not reach us later than March 1st.

CIRCULATION LARGER THAN THAT OF ANY OTHER RADIO PUBLICATION

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York, N. Y.

Agents Wanted

Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 405 Delaware Ave., Wilmington, Delaware.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

Write and learn how to start profitable business without capital or experience. Silvering mirrors, refinishing auto headlights, tableware plating. Outfit furnished. International Laboratories, Dept. 25, 809 Fifth Ave., New York.

Guaranteed Genuine Gold Leaf Letters anyone can put on store windows. Large profits, enormous demand. Free samples. Metallic Letter Co., 422 N. Clark, Chicago.

Easy, pleasant work for Mechanics, Shop Men, Clerks, during spare hours; will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Co., 476 Bar St., Canton, Ohio.

At Last! Diamond Rival Discovered! Amazing blue white Rajah Gem astounds jewelry world and deceives experts! Beautiful Sample Case Free! $100 weekly! Write quick! Rajah Diamond Co., Dept. F42, Salisbury, N. C.

$300.00 a month to distribute everyday household necessity in rural and small town districts. No money needed. Million dollar firm behind it. Write for particulars and state territory desired. B. P. Johnson, 611 W. Lake, Chicago.

Does $125.00 a week interest you? If it does, write us at once. We'll show you how to make it without obligation to you. A two-cent stamp and a minute of your time is the only investment you have to make. Will you make it and get the Facts about what is unquestionably one of the greatest selling opportunities in the field today. Address Dept. 306, William C. Bartlett, Inc., 250 West Adams Street, Chicago.

No dull times in the Food business. Selling Federal Pure Food Products is the greatest, surest and safest business in the world today and here is your opportunity to get into it. You can make $3,000, $5,000, $10,000 or more per year—the only limit is your ability to take care of the business. You will need no experience or money to get into this business as we send you our handsome $15.00 Sample Case on Trust and teach you everything you need to know. No Dull Times for the People must eat and our food products are the fastest selling, surest and quickest repeat order goods in the world. Sell on sight in every home where food is used—repeat orders immediatly and every week thereafter. A real big business all your own. Every new customer adds a great deal to your weekly income. Your business, once established, has a market value just like a store and can be easily sold. The greatest money making opportunity of your lifetime because you risk absolutely nothing as we Guarantee your sales, and we will not let you fail. Remember! Guaranteed! Best products, biggest sellers, surest repeat orders. No capital or experience is required. We furnish capital and everything necessary for you to Become a Federal Distributor. Exclusive territory will be given honest men or women who write at once. Federal Pure Food Company, 2309 Archer Avenue, Dept. J, Chicago, Ill. Largest packers of Pure Food specialties in the world. Reference, any bank, Dun or Bradstreet rating agency, Express or Railway Company in America.

Earn Money at home. Addressing, mailing circulars. Experience unnecessary. No selling. We pay weekly. York Supply Co., Dept. 141, 309 Fifth Ave., New York.

Agents—$12 Daily Easy, Introducing Largest Line New Style Guaranteed Hosiery. Cotton, Lisle, Chiffon, Silk—Latest shades and colors. Airdale, Tan-Bark, Picadilly, Beaver, 30 others. Prices greatly reduced. Special premiums to purchasers make sales easy. Radio Set given to Hustlers. Send for Proof of Profits—Free. Macochee Textile Company, Station 4743, Cincinnati, Ohio.

French Manufacturer Wants Agents with clientele. Highest class, 2 and 4 tube sets; half usual price. State territory and turnover. Address Garrigan, 83 rue Lamarck, Paris, France.

Radio Salesmen and Set Builders—We need you and you need us. If you are reliable and well known in your community, we will appoint you our representative and furnish you with standard well advertised sets and parts at prices that will enable you to sell at a handsome profit. Write at once for catalogue and sales plan. Waveland Radio Co., Div. 40, 1027 N. State St., Chicago, Ill.

Agents—500% profit. "Happy Home Maker Shampoo" builds your own big business. Martin of Indiana made $75.00 in one day. Missouri man made $750.00 one month. Exclusive territory. Geo. A. Schmidt & Co., 236A West North Ave., Chicago.

Can You Sell? All-wool, union made, tailored-to-measure suits for $19.75. Universal Tailors, K99 Bedford Street, Boston.

Agents Wanted—(Continued)

Radio—Join our sales organization and make big money. We want a man in every country to sell well advertised sets and parts made by the leading manufacturers. Widener of Kansas City makes $150.00 weekly. You can do as well or better. Write today for catalogue and discounts. Name your county. Waveland Radio Company, Div. 40, 1027 No. State St., Chicago, Ill.

Build splendid business making chipped glass number and name plates. Particulars free. Simplex Co., Dept. 75, 1133 Broadway, New York.

Wanted—District Purchasing Agents. No experience or money required. Write, Purchasing Manager, Dept. 12K, 5336 Berenice, Chicago.

Big Money Selling New Household Cleaning Set. Washes and dries windows. Sweeps, scrubs, mops. All complete only $2.95. Over half profit. Write Harper Brush Works, 160 3rd Street, Fairfield, Iowa.

Business Opportunities

Make $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, 813 Washington Blvd., Chicago.

Advertise, hundred magazines, three issues, 10c word. Pennell Company, Covington, Kentucky.

Free Instructive Book. Start little mail order business; home employment evenings. Outfit furnished. Pier, 867, Cortland Street, N. Y.

Chemistry

Learn Chemistry at home. Dr. T. O'Conor Sloane, noted educator and scientific authority will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 1809 of this issue. Chemical Institute of New York, 66 W. Broadway, New York.

Educational

Correspondence Courses—All schools sold complete at lowest prices. Easy terms, money-back guarantee. Courses bought for cash. Catalog Free. Mention subject. Economy Educator Service, 442-F Sansome, San Francisco.

Esperanto

Esperanto Books. Special for Radio News readers studying Esperanto—You need the excellent little Edinburgh Dictionary—$.75. Clothbound grammar and Dictionary combined $1.50. James Denson Sayers, Box 223, City Hall Station, New York.

Esperanto. Easiest and most successful method for studying the Esperanto Language ever published. Booklet of sample pages illustrated by 145 illustrations sent on request. Benson School of Esperanto, Inc., 20 Mercer St., Newark, N. J.

Esperantistoj! Al chiu samideano kiu skribos al ni leteron en Esperanto ni sendos tre plachan surprizon. Benson School of Esperanto, Inc., 20 Mercer Street, Newark, N. J.

For Advertisers

24 Words—355 Rural Weeklies $14.20. Admeyer, 4112-R Hartford, St. Louis.

Exchange

200-20,000 meter Receiver including Radiotron $25.00. Two step Amplifier $18.00. Smith, 4416 Market, Philadelphia.

For Inventors

Have You an invention or patent for sale on cash or royalty basis? Do you wish to buy a practical, money-making invention? Write us definitely what you have or want. We bring seller and buyer together. Address Western Security Co., 303 Hannibal, Mo.

Inventors' Educator: 900 Mechanical Movements. 50 Perpetual Motions. How to procure and sell patents. Mechanical Movements greatly assist Inventors, suggest new ideas. Explains how to select an attorney and avoid Patent Sharks. Price $1.50. Postage Free. Albert E. Dieterich, 690 Ouray Building, Washington, D. C.

For Sale

Typewriter—Cost $100, will sell for $35. Carnegie College, Rogers, Ohio.

For Sale—(Continued)

For Sale—Why bother with dry cells? Build an everlasting "Hawley" storage "B" Battery of the nickel-iron type. No frying or hissing, clearer reception and greater volume. Put up in both knock-down units and assembled types. Requires no soldering or former experience to put together. Knock-down units contain all the parts to build the following sizes: 90 volts $8.95; 100 volts $9.95; 120 volts $11.60; 135 volts $12.75; 150 volts $13.90; 200 volts $17.50. Sold on a 2 year guarantee with 30 day trial offer with return of your money without any ifs or ands. Sample cell 35c prepaid. 8 page illustrated folder of instructions containing simple means of putting together, making charger and charging. Complete manufactured charger $2.75. Order direct or write for my literature, guarantee and testimonials. Same day shipments. Address B. R. Smith, 31 Washington Ave., Danbury, Conn.

Health

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

Help Wanted

All Men, Women, Boys, Girls 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary; Write Mr. Ozment, 251, St. Louis, Mo., immediately.

Detectives Needed Everywhere. Travel. Experience unnecessary. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

Become a Landscape Architect. Uncrowded profession of wonderful opportunity for money-making. Easily mastered by mail. Earn while you learn. Write for book. American Landscape School, 11-E, Newark, New York.

Get posted. Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1769.

Earn $25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 972, St. Louis, Mo.

Man wanted (city or country) old established company will supply capital and start you in your own permanent business selling necessities people must buy every day. Experience unnecessary. Write McConnon & Co., Factory M63, Winona, Minn.

Men to build radio sets in spare time. Leon Lambert, 595-H Kaufman Bldg., Wichita, Kansas.

Insects Wanted

Get posted. Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1769.

Instruction

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 1809 of this issue. Chemical Institute of New York, 66 W. Broadway, New York City.

Manufacturers

Patented Articles, Models, Brass Work. Machine construction; Dies made. Baum's Metal Specialties, Kansas City, Mo.

Miscellaneous

Beautiful registered bull pups cheap. Bulldogs. 501 Rockwood, Dallas, Texas.

Get posted. Good prices paid for butterflies, insects. See Sinclair display advertisement, page 1769.

Friendship Magazine. Classy illustrated. 10c. RN Box 178, New Haven, Conn.

Polmet—The Wonderful Polishing Cloth that cleans all metals without liquid, paste or powder. Approved by "Good Housekeeping" and "Modern Priscilla"—sells fast at 25c. Sample free. F. C. Gale Co., 117 Edinboro St., Boston.

The Game of Radio, Everybody's playing it! 75c per deck, post-paid. Olde Tye Press, Box 224, Dover, N. J.

Can You Draw? Make money giving Chalk-Talks. Particulars. Truman's Studio, Box 765, Perrysville, Ohio.

Motorcycles. Bicycles

Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

News Correspondence

Earn $25 weekly, spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 973, St. Louis, Mo.

Novelties

Trick Cards that are absolutely guaranteed. Free samples. C. D. Blankenship, Adrian, W. Va.

Patent Attorneys

Inventors—Should write for our Free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Examination and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G Street, N W., Washington, D. C.

Inventors—who derive largest profits know and heed certain simple, vital facts before applying for patents. Our book Patent-Sense gives those facts; free. Write Lacey & Lacey, 631 F St., Washington, D. C. Established 1869.

Patents—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 269 Ouray Bldg., Washington, D. C.

Patents for Inventions. Long experience, highest grade work, rates reasonable, best references. Advice as to patentability. Wm. Ashley Kelly, 41 Park Row, New York.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278 Enright St., St. Louis, Mo.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 804 Jenifer Building, Washington, D. C.

Personal

Free to Men or Women—Information of a scientific nature that has brought physical vigor and happiness to thousands. No charge; no obligation. Write Fair Sales Co., Dept. 246A, Colorado Springs, Colo.

Lonely Hearts—Exchange letters; make interesting new friends in our jolly club. Eva Moore, Box 908, Jacksonville, Florida. Enclose stamp.

Lonely—Join Our Club. Make friends everywhere. Particulars free. Write Mrs. Mathews, Box 26, Oakland, Calif.

Know Thyself—Wonderful Three-Page Horoscope—your talents, character, love, friends, enemies, business. Send birthdate year, specimen of handwriting and 10c. Gargilis, Box 2771 G G, Boston, Mass.

Printing

500 Neargravure printed Letterheads—Envelopes $5.25 postpaid. Solliday's, Knox, Indiana.

Radio

Make Your Next Reach Out—Same panel, same layout, fewer parts. Our $5.00 Kit includes the one different part, 22 feet real gold sheathed wire, lithographed print of Kladag Coast to Coast Circuit, and complete, simple instructions. Nothing else to buy. Gives selectivity with deep, resonant volume. Not obtainable elsewhere. We originated this and can name scores of buyers it has delighted. Satisfaction Guaranteed. Details—10c. Kit prepaid anywhere, $5.00. New 48-page catalog, thousands of items, many exclusive for stamp. We accept postage stamps same as cash. Kladag Radio Laboratories, Kent, Ohio.

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalog. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal, 75c prepaid. Send for yours today. Radio Specialty Company, 96-98 Park Place, New York City.

Ivory Radio Panel: Grained white "Ivorylite" makes most beautiful set of all. Guaranteed satisfactory. Any size 3-16" thick sent prepaid 3c per square inch. Sample free. E. P. Haltom, Dept. N, 614 Main St., Fort Worth, Texas.

Send me your burned out or broken Power tubes—50 watts or over. Will pay liberally. W. Baker, 36 W. 20th St., New York City.

Tetradyne—Transcontinental all standard parts, simple to build, three tube, powerful receiver. Your opportunity to enter the Radio business or build your own set. For full particulars address, Tetradyne, 385 45th St., Milwaukee, Wis.

Solid Mahogany Cabinets — 7x10—$2.45; 7x12—$2.75; 7x14—$3.00; 7x18—$3.40; 7x21—$3.70; 7x24—$4.10; 7x26—$4.55. Postage extra. Variocouplers—Bakelite, green silk windings, $4.50 value, for $2.35 postpaid. Miami Cabinet Company, Yellow Springs, Ohio.

Attention!—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalog, which contains raw materials and parts in a greater profusion than any other catalog. 15c in stamps, or coin, will bring the catalog to you. Radio Specialty Co., 96-98 Park Place, New York City.

Radio—(Continued)

Tested Galena crystals 50c pound—untested. 25c. Box 1005, Joplin, Mo.

Two stage Magnavox $35. Cockady set $30. Parts galore. Box 38, Krayn, Pa.

Do not risk blowing out your tubes, no fuses, something new, lasts forever, send your address and 50c and get next. John Deck, 2913 Massachusetts Ave., Cincinnati, Ohio.

Sacrifice—6 Tube Ultradyne and Hayes 2 Step Amplifier. Write. Frank Jackson, Pine Apple, Ala.

Have your broken and burned out Power tubes repaired, 50 watts or over. Send them to us for Repair. Charges reasonable. Wm. Baker, 36 W. 20th St., New York City.

Save money on Radio Sets—Lists free. The Radio Shoppe, Box 645, East Liverpool, Ohio.

Join the Radio Parts Exchange Club. Your parts inspected (Fee 25c) and exchanged for the parts you need. What have you; what parts do you require? Write us for details. The Radio Parts Exchange Club, 112 So. Homan Ave., Chicago.

Silver has the lowest resistance. Silverplate your Aerial, Condenser, Bus bars, etc., with "Silvoplate" and reduce your losses. A guaranteed pure Silver Solution. Three sizes; 35c, 60c and $1.00. If your dealer cannot supply you, send direct to: Silvoplate Co., 125 Church Street, N. Y.

Radio Builders—Order a set of Nine Standard Radio Drills in Canvas Tool Roll for One Dollar. Postage Prepaid. South Bend Sales Company, South Bend, Indiana.

Acme 4 tube Reflex Set, with Music Master Loop, 1500 mile range on horn $75.00. $120.00 Fada One Sixty Neutrodyne $75.00. Low Loss 3 Tube Uncle Sam Set $35.00. We will save you money on any set. Hoffman, 5739 N. 6th Street, Philadelphia, Pa.

15 to 25 per cent. discount on nationally advertised sets and parts. Every item guaranteed. Tell us your needs. Imperial Radio Company, Delaware, Ohio.

Radio Fans. You have heard Miami, Florida. Now send 10 cents for 10 beautiful Postal Cards of Miami, all different, "No Comic or Trash." Standard Card Co., Box 8558, Miami, Fla.

2650 Miles Distance with one tube. Any Novice understands our simplified instructions. Big free booklet tells the story. Vesco Radio Co., Box RC-117, Oakland, Calif.

Build Your own wave trap. Complete kit $4.50 with cabinet. Cuts out interfering stations. Assures selectivity. Permits greater volume. Blue prints 27c. W. Bullen, 1418 Clairmount, Detroit, Mich.

Sacrifice—Murad MA15—$138.50 with loop aerial. One Zenith 4R-4 tube set $65.00. Both sets A1 condition. Amateur Radio Supply Shop, Box 144, Maitland, Fla.

Salesmen Wanted

A Salesman wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000 ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $2.00 for sample outfit. The Radiogem Corp., 66-R West Broadway, New York City.

Salesmen Wanted in every town or city to handle a good line of radio crystals—big money to the right men. Send 50c for five different samples. Big Four Radio Crystal Company, 216 Monroe Avenue, Detroit, Michigan.

Salesmen—Sell four Square Suits $12.50—guaranteed two years. All wool overcoats $19.50, five different patterns. $3.00 to $5.50 each sale. Profits in advance. Complete line, coat, vest, pants, riding pants, overcoats, slip-ons, caps. One day delivery. District territories open. Stone-Field Corporation, W2556 So. Wabash, Chicago.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Stamps and Coins

158 Genuine Foreign Stamps. Mexico War Issues, Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets 50 to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps. Estab. 20 years. Hussman Stamp Co., Dept. 146, St. Louis, Mo.

You'll get profit and pleasure collecting old coins. Send 10c for genuine old coin and large coin catalog. This is just a get-acquainted offer. Send today. You'll be delighted with it. B. Max Mehl, Numismatist, Dept. R, Mehl Building, Fort Worth, Texas. Largest Coin Firm in U. S.

Telegraphy

Telegraphy—Both Morse and Wireless taught thoroughly. Big salaries. Wonderful opportunities. Expenses low; chance to earn part. School established fifty years. Catalog free. Dodge's Institute, Cour St., Valparaiso, Ind.

Telegraphy. Morse or Radio taught at home. SOS; Broadcasters silent. Human tragedy at sea. Learn the code, get the greatest thrill of radio. Booklet RS free. Learn-O-Graph Co., Ridgefield Park, N. J.

Wanted to Buy

Full Value Paid for Old Gold, Jewelry, Watches, Diamonds, crowns, bridges, dental gold, silver, platinum, gold or silver ore; magneto points, old false teeth. Packages returned if our offer is not satisfactory. United States Smelting Works (The Old Reliable) 120 So. State St., Dept. 16, Chicago, Ill.

Stamps for Collectors

1000 Different Stamps, wonderful quality, $1.00. C. E. Nickles, 2912 Rodman, Washington, D. C.

How Radio Is Received

BOOK NO. II

By R. S. OULD

of the Bureau of Standards of the U. S. Government

This new book of the E. I. Co. tells thoroughly and completely just how radio is received. How the radio waves originate, are sent out into space and finally received on the antenna and telephones. It enables you to understand the principles of the reception of the voices and music you receive daily out of the air.

This is one of the handiest of the E. I. Co. books for the amateur radio listener. It explains in a very clear way how Radio is transmitted and received. It contains 64 pages, size is 5 x 8 inches and is bound with a stiff cardboard cover and printed in two colors.

On Sale At All Radio and News Dealers

PRICE 25c

Published by

THE E. I. COMPANY

The Consrad Company

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233 Fulton St., New York, N. Y.

A Special Offer!

An opportunity for radio fans to save money in buying Celoron Panels and Vulcawood Cabinets

WE are making this special introductory offer to make new friends for our products and for the dealers who sell them.

Celoron is the standard insulating material among leading radio manufacturers and it is the choice of nearly a million radio fans. It is made by the oldest and largest manufacturer of vulcanized fibre and laminated technical materials in the world. In spite of these facts there are many fans who never have had an opportunity to see and use this popular insulating material. Many others have never heard of the Vulcawood Cabinet—the new cabinet of bakelite.

For a limited time, we offer you the privilege of buying these standard, well-known parts direct from our factory—at special introductory prices. Orders will be accepted subject to the conditions outlined below.

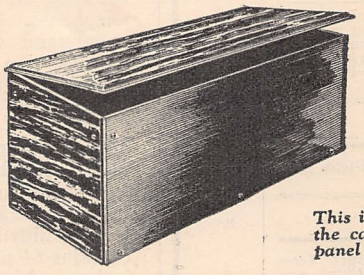
This offer expires on April 30, 1925.

Your money back if not satisfied

If your dealer does not stock and carry these parts, you may select a cabinet, and the panel to fit it, at the special introductory prices quoted.

In return for this privilege we ask you to send us your dealer's name and the names of three of your friends who are radio fans.

We shall refund your money without a whimper if you are not entirely satisfied with the goods when received. No red tape—no delay—no questions asked.



This illustration shows the cabinet—with the panel in place.

NEW VULCAWOOD CABINET

the only bakelite cabinet made

This new bakelite cabinet insulates your entire set. It protects your delicate instruments from dust and dirt. It eliminates troublesome body capacity effects.

The Vulcawood Cabinet is grained and colored to match beautiful hand rubbed mahogany. It comes packed flat and is easy to set up.

Vulcawood Cabinet Prices

Sizes	*List Prices*	*Special Prices*
(1) 7 x 7 x 10	$7.95	$4.50
(2) 7 x 7 x 12	8.10	4.50
(3) 7 x 7 x 14	8.10	4.50
(4) 7 x 7 x 18	9.40	4.50
(5) 7 x 7 x 21	10.40	6.50
(6) 7 x 7 x 24	10.40	6.50
(7) 7 x 7 x 26	10.55	6.50
(8) 7 x 7 x 30	11.15	6.50

DIAMOND STATE FIBRE COMPANY

Bridgeport, Pa., and Chicago, Ill.

Branches in Principal Cities — Toronto, Canada—London, England

CELORON RADIO PANELS

universally endorsed by radio experts

Celoron will help you get better results from your radio hook-up. It will give your instruments thorough, leak-proof insulation. It will help you get greater distance, greater volume.

A Celoron Panel will not soften with heat or deteriorate with age as do rubber and composition panels. It retains its beauty and its insulating properties indefinitely.

Celoron Panel Prices

Sizes	*List Prices*	*Special Prices*
(1) 7 x 10 x 1/8	$1.09	$1.00
(2) 7 x 12 x 1/8	1.31	1.00
(3) 7 x 14 x 1/8	1.53	1.00
(4) 7 x 18 x 3/16	2.95	1.00
(5) 7 x 21 x 3/16	3.45	2.00
(6) 7 x 24 x 3/16	3.94	2.00
(7) 7 x 26 x 3/16	4.25	2.00
(8) 7 x 30 x 3/16	4.92	2.00

If your dealer does not carry Celoron, order by mail

In ordering please follow these simple directions:

1. Indicate on the coupon the size of the panel and the size of the cabinet you want.
2. Print in your name and address carefully.
3. Clip out the coupon and attach it to a plain sheet of white paper.
4. **Mark on the white sheet the name and address of your dealer and the names and addresses of three friends who are radio fans.**
5. Attach your check or money order to the white sheet.
6. Mail all papers to the Diamond State Fibre Co., Bridgeport, Penn.

DIAMOND STATE FIBRE COMPANY,
Dept. 100
Bridgeport, Pennsylvania

Please send me prepaid the following items:

Celoron Panel Size No. . . . . Price $.....

Vulcawood Cabinet (without panel) Size No. Price $.....

Check attached $..... Total $.....

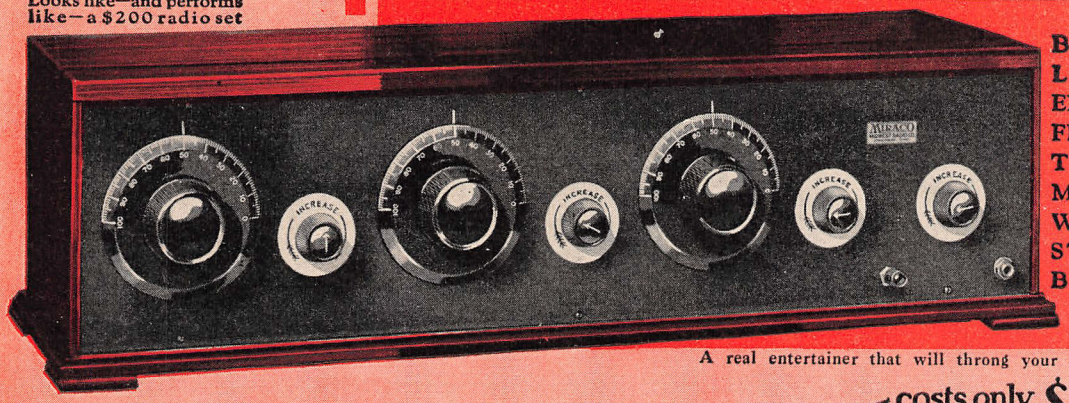
Name.....

Street.....

City.....State.....

Combines distance, selectivity, power, deep full tone, beauty and simplicity!

Looks like—and performs like—a $200 radio set



BUILT TO GIVE LOUD SPEAKER ENTERTAINMENT FROM STATIONS THOUSANDS OF MILES DISTANT WHILE LOCAL STATIONS ARE BROADCASTING

A real entertainer that will throng your home with friends!

"Coast to Coast" reception verified by Miraco Users

NOTE! Do not judge Miraco sets by their prices. Enormous production makes them cost less. They are built—by pioneer set makers—of highest grade parts. They embody improvements, refinement and features used in the most costly sets. Every Miraco user is an enthusiastic booster—these letters are typical of the many we receive.

Maryland Hears Europe

During International Radio Week I received European stations several times upon my Miraco. Who wouldn't be satisfied with results like this?—Jos. E. Cook, Owings Mills, Md.

California Hears East Coast

Miraco works fine. Last night I got Cuba on loud speaker. I also pick up East Coast programs in spite of local interference.—Clinton Elliott, Long Beach, Calif.

Illinois Hears London

Miraco operates wonderfully. Thursday night I heard the program from the Hotel Savoy, London, for about 35 minutes.—Carl Mackey, White Heath, Ill.

Bermuda Hears California

On my Miraco I have received KGO at Oakland, Calif., a distance of over 3,000 miles, four times in last four weeks. Also have received five stations about 2,000 miles away and about twenty over 1,000 miles away.—I. O. L. Spurling, Spanish Pt., Bermuda.

Nevada Hears Cuba

Am able to get all Eastern Coast stations with my Miraco as well as Havana, Cuba, and Mexico City. Also all Canadian stations. Had Havana loud enough to broadcast same over telephone a distance of 300 miles.—A. A. Ewing, Rox, Nevada.

Vermont Hears Mexico

I have received stations as far as Mexico City, Mexico; Calgary, Canada, Cuba and Texas on my Miraco.—A. V. Little, Vergennes, Vt.

Massachusetts Hears Belgium

Nov. 27th at 11:25 P. M. I heard 2LO London, England, on the Miraco. Nov. 29th at 11:40 P. M. heard SBR, Brussels, Belgium. You can't get a better set for the money.—M. J. Discoe, Pittsfield, Mass.

N. Y. Minister Hears Europe

I tuned in four different European stations last week on my Miraco. My guests and I heard 5NO Newcastle, England, very clearly—a piano solo from Rigoletto. Also heard voice in Italian announce IRO, Rome, Italy. Concerts from other stations came through, but static crashed at their conclusions—one was in Flemish.—Rev. Thos. E. Owen, St. Patrick's Rectory, Rossie, N. Y.

Pennsylvania Hears California

Have listened to Cuba, California and possibly 100 other stations. All who hear Miraco proclaim it the best they have ever heard.—G. H. Stevens, Altoona, Pa.

Nebraska Hears Cuba

Miraco is a wizard. I have handled radios for two years—have not seen its equal under $200. Heard Havana, Cuba, Saturday night despite that their language is hard to discern on a radio.—C. G. Stockman, Snyder, Nebr.

costs only $75

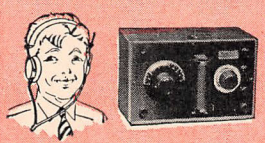
The Marvelous MIRACO Ultra 5

Send coupon for SPECIAL OFFER!

[FIVE TUBE OUTFIT IN BEAUTIFUL SOLID MAHOGANY CASE]

Completely built, thoroughly tested and factory guaranteed by one of America's oldest and most reliable manufacturers of quality sets! Years of experience and quantity production explain its almost incredible price. Users, who have deluged us with commendations, say that friends **who see and hear it** are amazed that it sells for less than $150 or $200. Radio experts, who **know** good construction and quality parts, are equally astonished. You, too, will be delighted, thrilled, amazed with your big five-tube Miraco **"Ultra 5"** in its beautiful hand-rubbed **solid mahogany** cabinet! You'll be envied by radio friends who paid big prices for their outfits.
Imagine getting all this for $75—a beautiful sweet toned "coast to coast loud speaker" set, composed of finest parts, housed in solid mahogany, equipped with the latest improvements, refinements and features found on costliest sets—and factory guaranteed! An instrument approved by radio's highest authorities! A set anyone can connect and operate. Even beginners learn quickly to cut through the "locals," get distant stations loud and clear, log stations and return to them at will. (Full directions with each set.) It is non-radiating, non-distorting, non-howling. Has cut-out switch—and a first stage phone jack for tuning—on Bakelite panel. All wiring concealed under Bakelite sub-base. Works on storage battery or dry cells. Literature describes other newest features.

Other Miraco Long Distance Sets $14.35 up

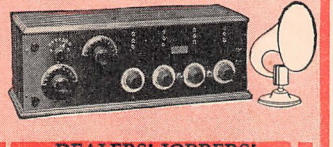


Users tell us that Miraco Model R justly deserves its title, "Radio's finest low priced quality receiver." One tube acts as a tuned radio frequency amplifier and detector combined. A great distance getter. Easy to operate and log. Covers all wave lengths 150 to 625 meters. Like all Miraco sets, it operates on a storage battery or dry cells. Never such value before at only $14.35

MIRACO RADIO GETS 'EM COAST to COAST

This wonderful new Miraco Model R-3 is the three-tube, long distance, loud speaker set that has created such a sensation. Easy to tune and log. Covers wave lengths 150 to 625 meters. Detector acts also as a tuned radio frequency amplifier. 2 stages audio frequency amplification. Has no equal for simplicity, volume, range or clearness at anywhere near its price **Miraco R-3 only $29.50**

These Miraco sets are as easy as a phonograph to operate. Built throughout of highest grade parts. Full directions for connecting and operating supplied with each set. No experience necessary. The three and four tube sets have cut-out switch and first stage phone jack. Each set completely built, thoroughly tested and factory guaranteed.



The famous Miraco Model MW four tube "coast to coast loud speaker" outfit which users all over the country report outperforms and outdistances much costlier sets. Comes in a solid mahogany cabinet. The improved 1925 model is equipped with cut-out switch, first stage phone jack for tuning (removing plug automatically switches program to loud speaker) and other latest features. Employs one stage of radio frequency amplification, detector and two stages of audio frequency amplification. Another unmatched Miraco value, $54.50.

All the Proof you want is waiting for You!

Reports from the many users in every state prove Miraco Tuned Radio Frequency Receivers—at rock bottom prices—have efficiency of sets costing up to three times as much. Remember that Miraco Sets are the product of a long established, reputable manufacturer—pioneer builders of sets. Send for further evidence that they are Radio's finest moderately priced receivers. All Miraco sets bear the endorsement of radio's highest authorities. Mail coupon now for latest bulletins and plenty of additional testimony from users leaving no doubt that "Miraco Radio Gets 'em Coast to Coast."

DEALERS! JOBBERS!
Write for the new Miraco proposition. Nation-wide use and popularity of Miraco Sets, their amazingly low prices and our extensive advertising, makes them wanted everywhere. Send coupon.

AGENTS!
The wonderful tone, volume and distance-getting ability of Miraco Sets makes them easy to sell. Send coupon for proposition, good territory open.

Send coupon for free bulletins [or order direct from this ad]

MIDWEST RADIO CORPORATION
Pioneer Builders of Sets
Cincinnati, Ohio
404-W East Eighth Street

Send free literature, your SPECIAL OFFER and all particulars regarding Miraco Sets. ( ) Jobber. ( ) Dealer. ( ) Agent. ( ) User.

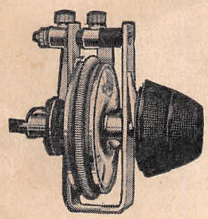
Name .....

Address .....

C-H

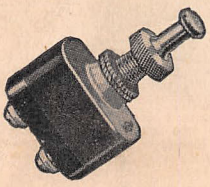
"Buy With Care—
Build With Confidence"

The Better You Build—*The More Carefully You Must Buy!*



C-H Rheostats

For all tubes. Four Ohm, with or without vernier for detector and amplifier tubes, respectively. Thirty ohms for ¼ ampere tubes. C-H Potentiometer of similar design.



C-H Radio Switch

The original radio switch with the patented and exclusive C-H snap mechanism that assures long life and perfect operation.

The C-H trade mark has had an important mission in radio. In the early days when much apparatus was put on the market without sufficient engineering this mark of the world's leading electrical engineers served to guide non-technical and experienced enthusiasts alike to the construction of successful and efficient receiving sets.

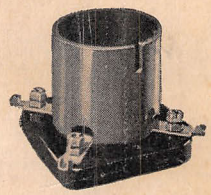
Dealers were glad to recommend these parts to their customers knowing that Cutler-Hammer could only afford to stamp with their trade mark apparatus whose performance would more than justify their guarantee.

And today this quality takes on a new importance. Bigger sets—elaborate cabinets—mean a large investment, and care in the purchase of parts is doubly necessary. Demand the C-H trade mark and build with success.

THE CUTLER-HAMMER MFG. CO.

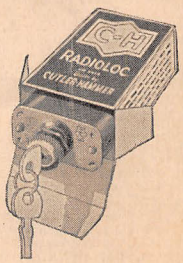
Member Radio Section, Associated Manufacturers of Electrical Supplies

MILWAUKEE, WISCONSIN



Low Loss Socket

The departure in socket design that set fans talking everywhere. Silvered contacts—Bakelite and Thermoplax construction. Insist on the socket with the ORANGE *shell.*



C-H Radioloc

The new lock for your radio set. Protects tubes and batteries from meddling fingers and the children. Carry the key on your ring.

CUTLER-HAMMER